No. 862,402. PATENTED AUG. 6, 1907.

C. L. KRUM.

PRINTING TELEGRAPH.

APPLICATION FILED OCT. 6, 1904.

8 SHEETS—SHEET 1.

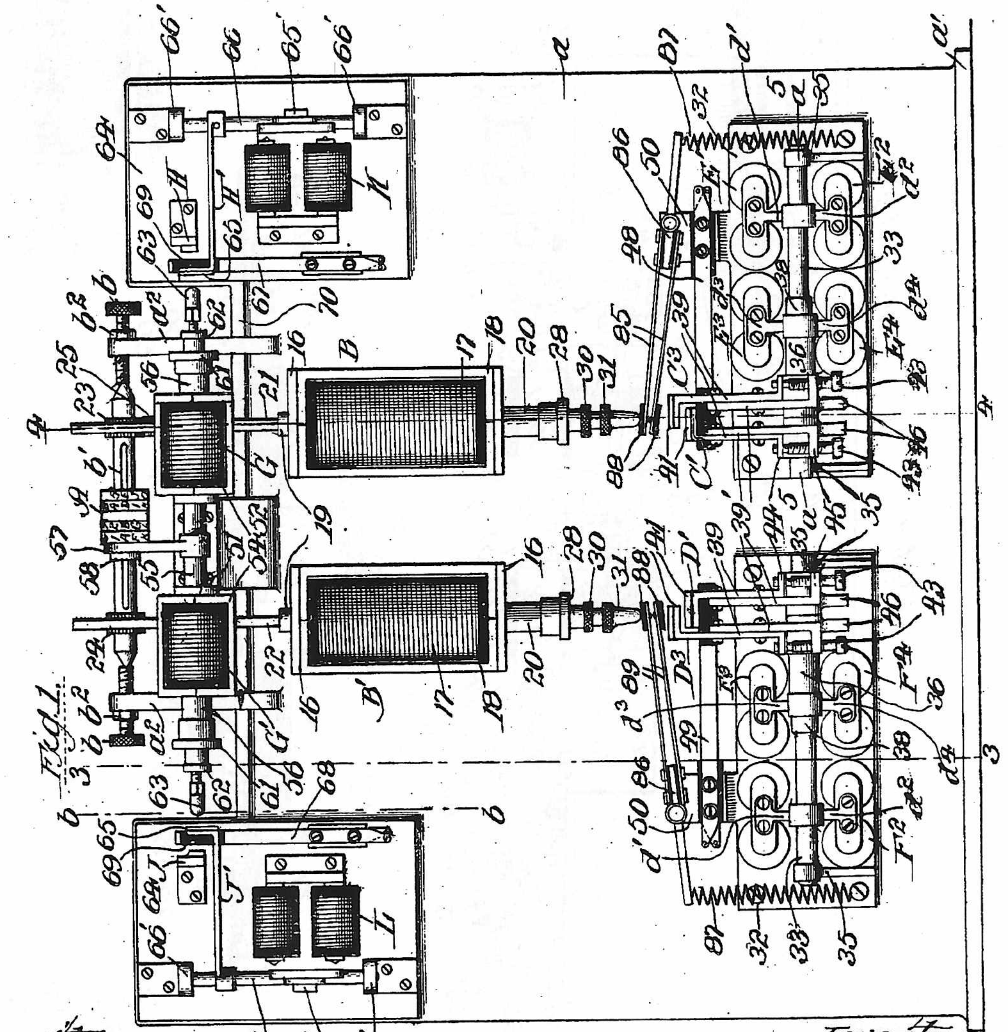

Fig. 1.

Witnesses:

Lillian Prentice

Lute L. Alter

Inventor:

Charles L. Krum

By Peirce + Fisher

Attys.

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8 SHEETS—SHEET 2.

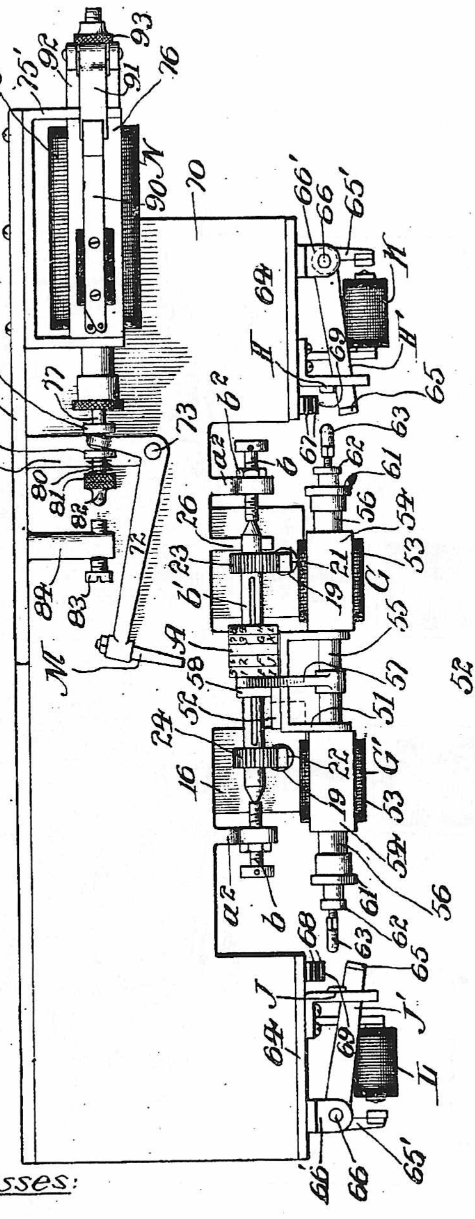

Fig. 2.

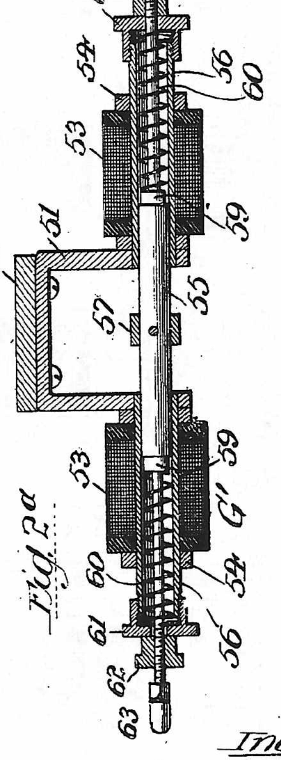

Fig. 2a

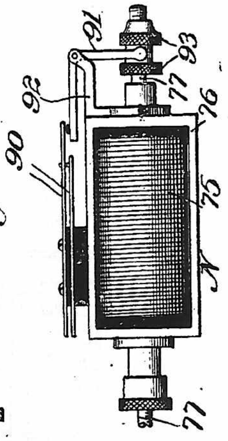

Fig. 2b

Witnesses:

Lillian Prentice

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8 SHEETS—SHEET 3.

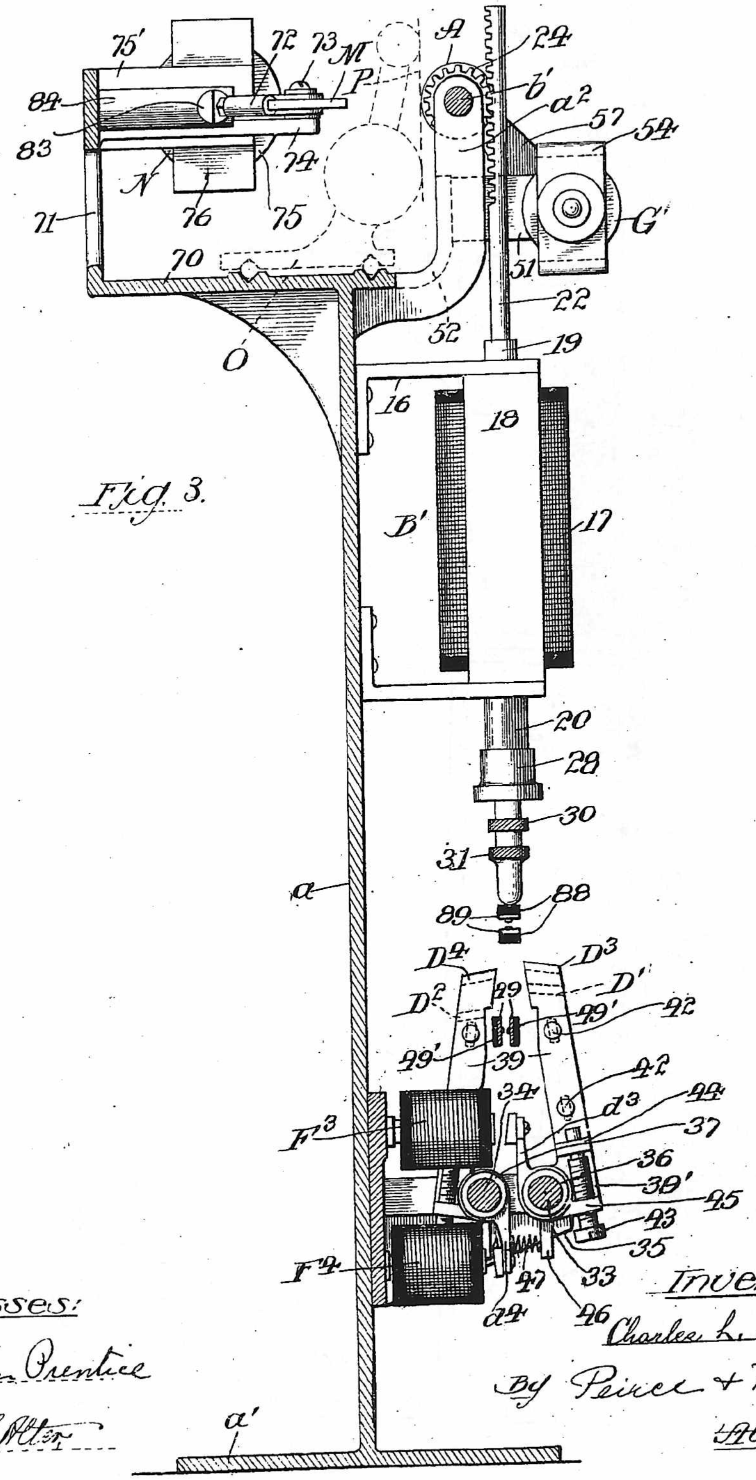

Fig. 3.

Witnesses:

Lillian Prentice

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8 SHEETS—SHEET 4.

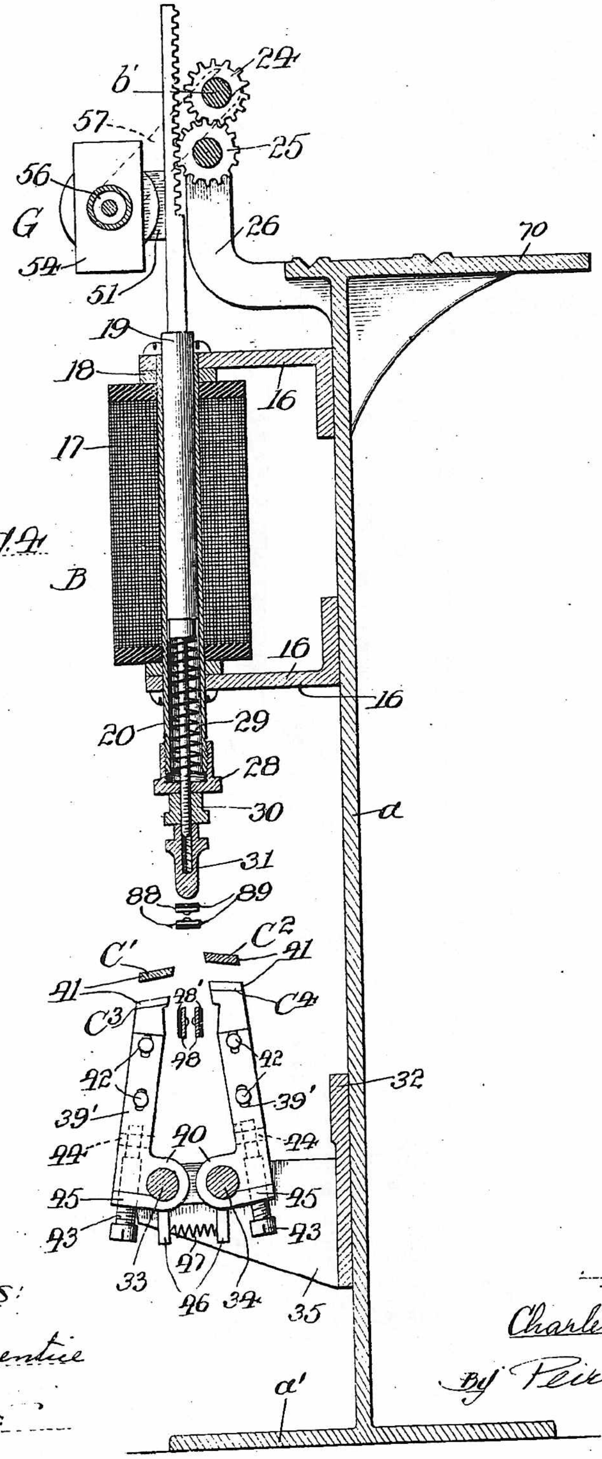

Fig. 4

Witnesses:

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Fig. 5.

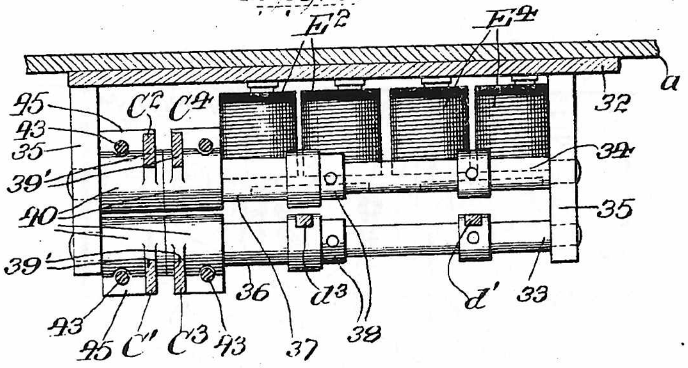


Fig. 5a

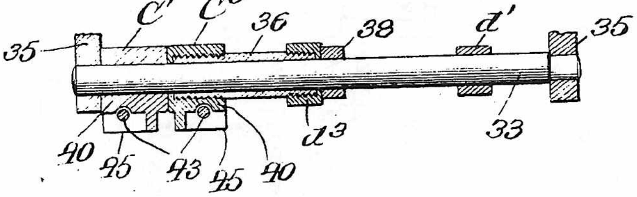
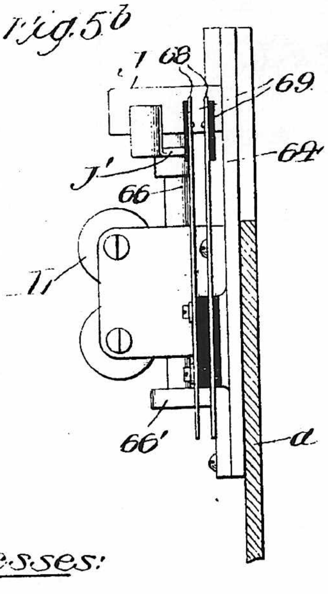


Fig. 5b



Witnesses:

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APPLICATION FILED OCT. 6, 1904.

8 SHEETS—SHEET 6

Fig. 6.

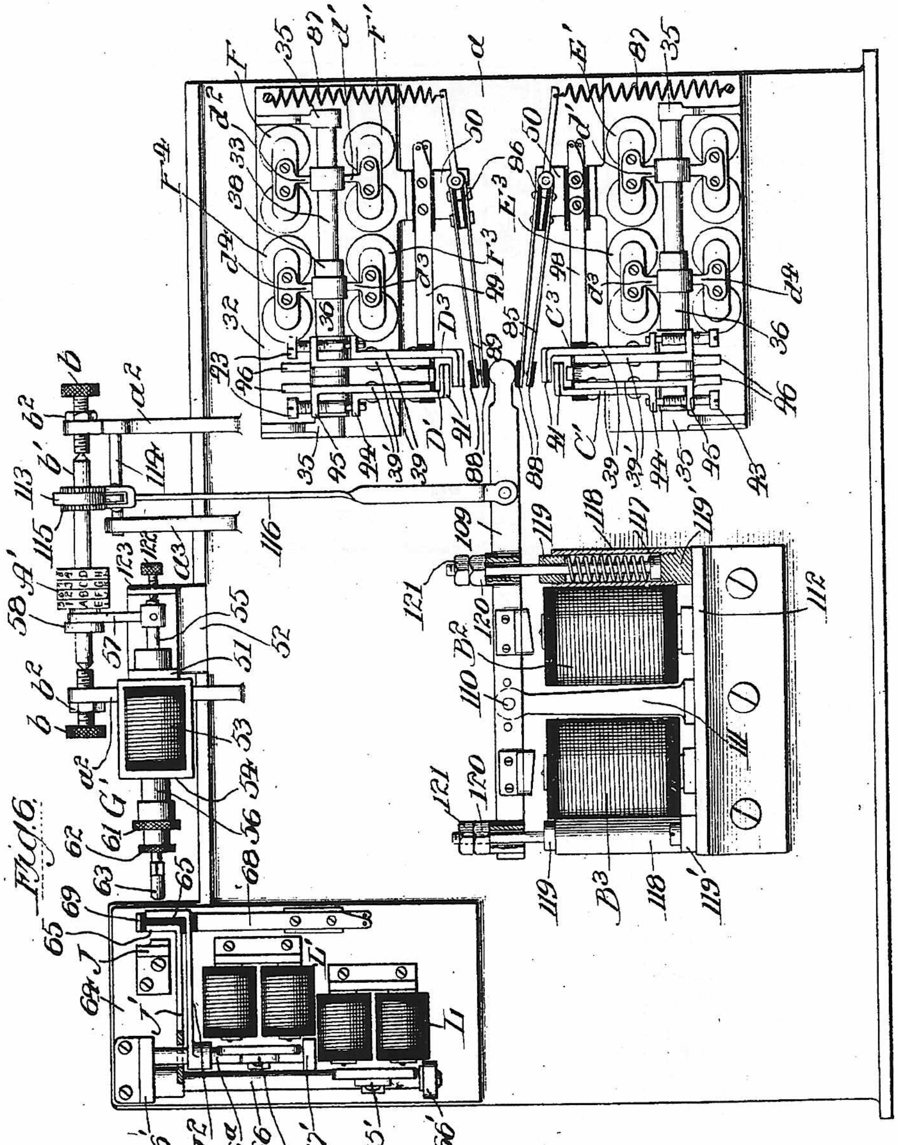
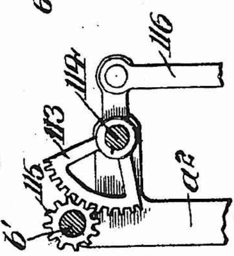


Fig. 6a.



Witnesses:

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Luta L. Alter

Inventor:

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Att'ys.

No. 862,402.

PATENTED AUG. 6, 1907.

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PRINTING TELEGRAPH.

APPLICATION FILED OCT. 6, 1904.

8 SHEETS—SHEET 7.

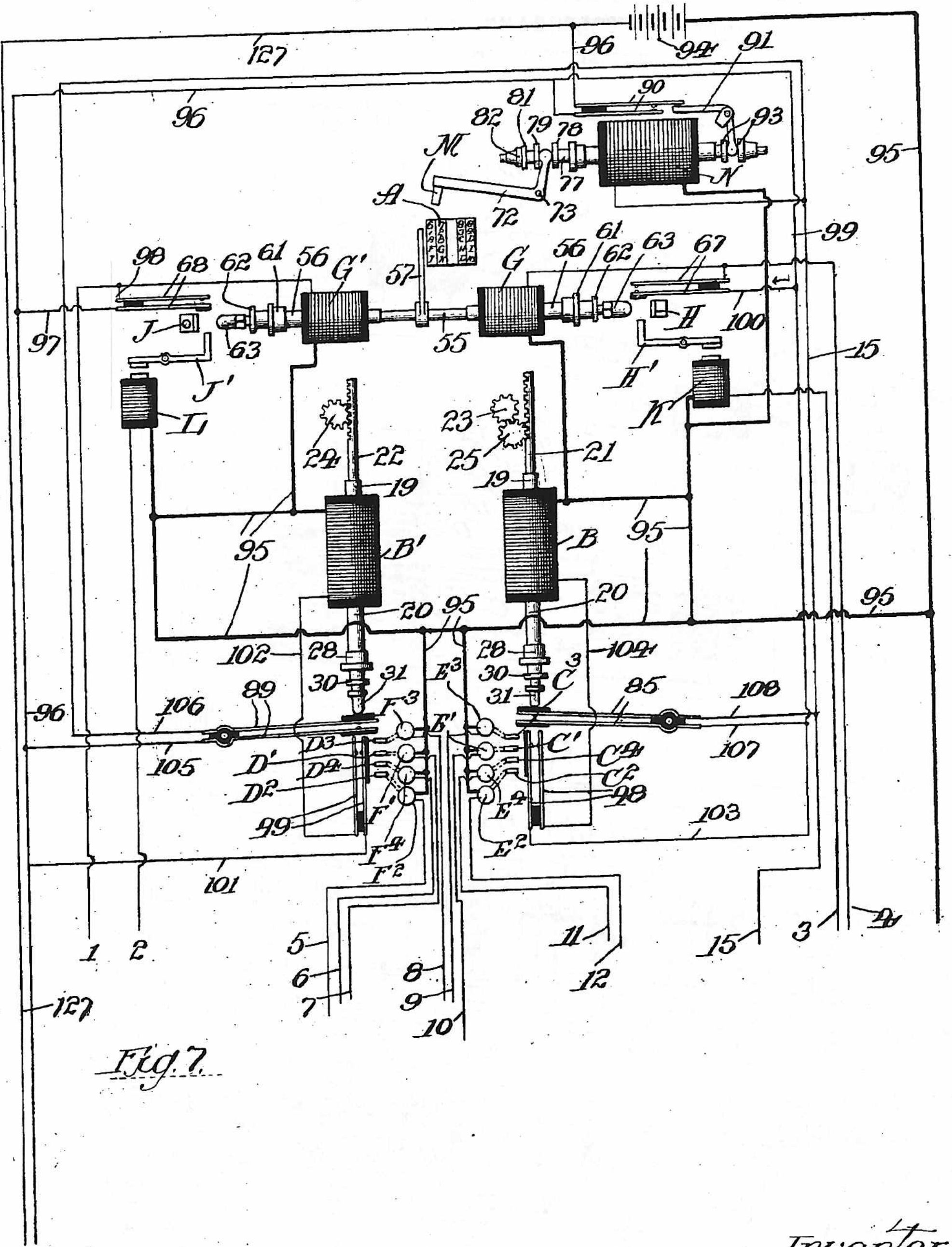

Fig. 7.

Witnesses:

Lillian Prentice

Lute S. Alter

Inventor:

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Attys.

No. 862,402.

PATENTED AUG. 6, 1907.

C. L. KRUM.

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APPLICATION FILED OCT. 6, 1904.

8 SHEETS—SHEET 8.

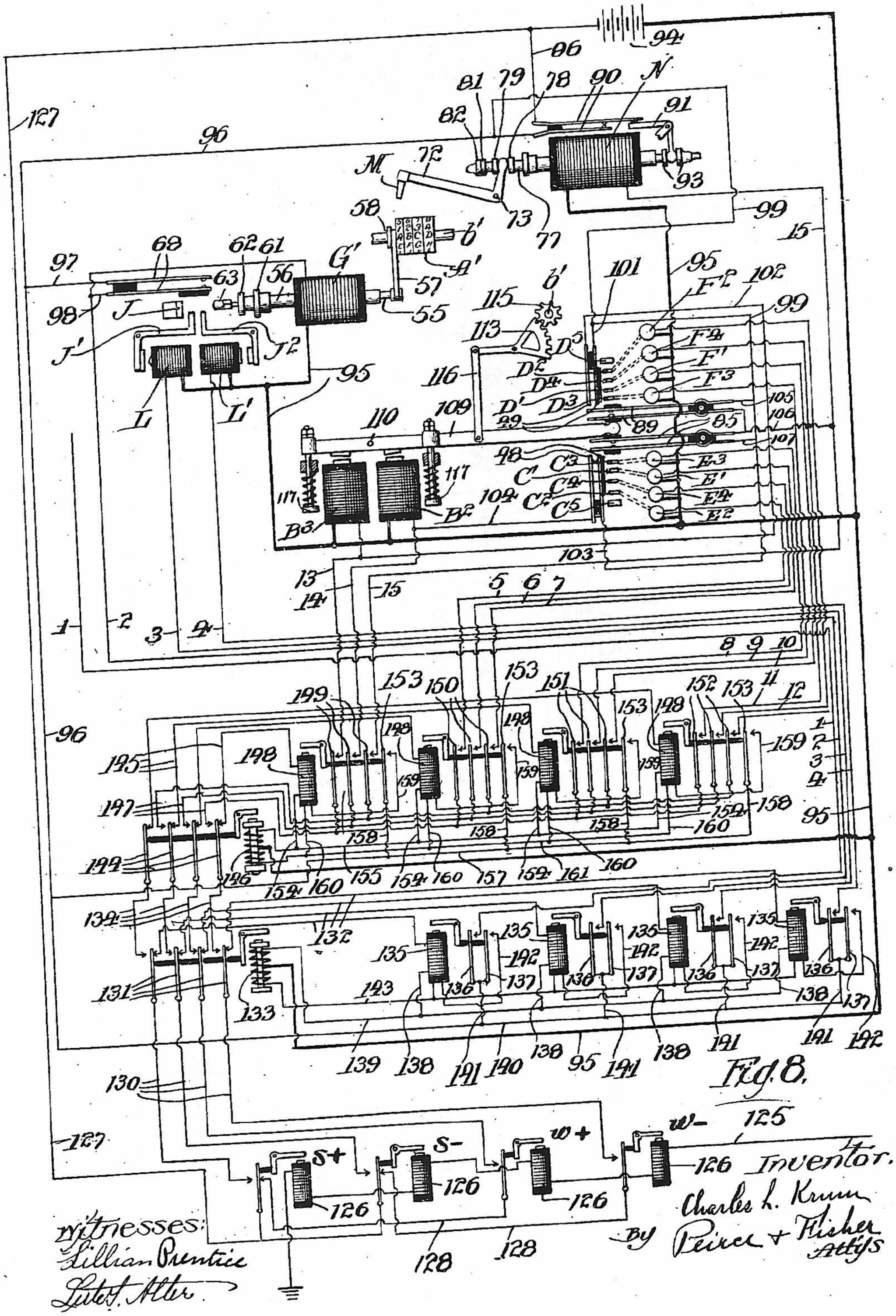

Fig. 8.

Witnesses:
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Lutie J. Alter

Inventor.
Charles L. Krum
By Peirce + Fisher
Attys

UNITED STATES PATENT OFFICE.

CHARLES L. KRUM, OF CHICAGO, ILLINOIS.

PRINTING-TELEGRAPH.

No. 862,402. **Specification of Letters Patent.** **Patented Aug. 6, 1907.**

Application filed October 6, 1904. Serial No. 227,467.

To all whom it may concern:

Be it known that I, CHARLES L. KRUM, a citizen of the United States, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Printing-Telegraphs, of which the following is declared to be a full, clear, and exact description.

The improvement relates to printing apparatus and controlling electric devices for automatically recording telegraphic messages and seeks to provide a simple and effective arrangement which will operate with rapidity and certainty.

The invention consists in the features of construction, combinations and arrangements of parts hereinafter set forth, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

In the drawings: Figure 1 is a front elevation of the improved telegraphic printing apparatus. Fig. 2 is a plan view thereof. Fig. 2^a is a horizontal section of the side shifting devices for the type wheel or carrier. Fig. 2^b is a view in elevation of the printing hammer magnet. Figs. 3 and 4 are detail sections on lines 3—3 and 4—4 respectively of Fig. 1 illustrating the shifter mechanism for rotating the type wheel. Figs. 5, 5^a and 5^b are detail sections of parts taken on lines 5—5, *a*—*a* and *b*—*b* respectively of Fig. 1. Fig. 6 is a front elevation of a modified form of the invention. Fig. 6^a is a detail view of parts shown in Fig. 6. Fig. 7 is a diagram of the operating circuits for the form shown in Fig. 1. Fig. 8 is a diagram of the operating circuits for the form shown in Fig. 6, and of the controlling electric selecting means.

The apparatus may be mounted upon any suitable frame. In the form shown, the frame comprises an upright plate a, having a suitable base section or foot a'. At the upper part of the frame are arranged a pair of uprights a^2 offset in front of the frame plate, as shown in Figs. 3 and 4. Pivot screws b adjustably threaded through the uprights a^2 engage the cone-shaped ends of a horizontal shaft b' which carries the type-carrier or wheel A. Lock-nuts b^2 hold the pivot screws b in adjusted position.

Type-wheel A is preferably provided with a plurality of rows of type and is keyed to rotate with shaft b', but is free to shift laterally thereon. Suitable shifter mechanism is provided for rotating and laterally shifting the type wheel to bring any of the type thereon to the printing point. In the form shown in Fig. 1, the shifters for rotating the type-wheel are actuated by a pair of electro magnets preferably in the form of solenoids B, B'. These solenoids are alike in construction and each is supported upon the front of frame plate a between a pair of brackets 16. Each solenoid comprises a vertically disposed spool 17 surrounded by a rectangular piece 18 of soft iron and having a shiftable core-piece 19 of soft metal. Each core 19 is arranged to slide within a tube 20 of brass or other suitable non-magnetic material which extends through the spools of the solenoids and projects below the same to a considerable extent.

The solenoid cores 19 are provided with toothed racks 21 and 22 at their upper ends which coöperate with pinions 23 and 24 on opposite ends of shaft b' to rotate the type-wheel in opposite directions. In the form shown, an intermediate or idle pinion 25 is journaled upon an offset upright or lug 26, which projects from the upper end of the frame plate a (see Fig. 4) and this idler is interposed between the rack 21 and the pinion 23. The spools 17 of the solenoids B, B' are so wound that when energized the cores 19 and the racks 21 and 22 are drawn downwardly, and by properly energizing one or the other of said solenoids, the type-wheel may be rotated in one or the other direction. Each solenoid core 19 (see Fig. 4) rests upon the head of stop-plunger 27, arranged within the tube or cylinder 20. The stem of the stop-plunger 27 extends through a cap 28 upon the end of the tube 20, and a spring 29 coiled about the stem extends between cap 28 and the head of the stop-plunger to yieldingly hold the latter in position. The position of the stop-plunger 27 and the tension of the spring 29 may be properly adjusted by means of the cap 28 and a thumb-nut 30, which are adjustably threaded upon the ends respectively of the tube 20 and the stem of the plunger. Thumb-nut 30 is of course held into engagement with the cap-piece 28 by the spring 29. A lock-nut or stop-member 31, having a rounded lower end is threaded upon the extreme lower end of the stop-plunger stem, as shown. By this arrangement of yielding stop-plungers, which are held against movement in one direction, but yield in opposite directions, the type wheel and rotating shifters therefor, may be held in central position, but are free to be actuated to rotate the type wheel in opposite directions from normal against the resistance of one or the other of said stop-plungers. Moreover, the stop-plungers may be adjusted to securely, yet yieldingly hold the type wheel in central position so that all "back lash" or lost play between the connected parts is taken up.

The rotating of the type wheel in each direction is variably arrested in one direction by a set of stop-arms C', C^2, C^3 and C^4, and in the other direction by a set of stop-arms D', D^2, D^3 and D^4, which, in the form shown, are arranged respectively beneath the solenoids B, B' and shiftable into the path of movement of the stop-members 31 upon the ends of the stop-plungers 27, to variably limit the movement of the corresponding shifters operated by the solenoids.

The separate sets of stop-arms and the operating devices therefor, are alike except that they are oppositely arranged beneath the separate solenoids as shown.

Each set is arranged upon a suitable support 32, secured to the front face of the frame plate 10. A pair of rock-shafts 33 and 34 (see Figs. 3, 4 and 5) are journaled between forwardly extending lugs or brackets 35 upon the supports 32, and the stop-arms C', C^2 are secured to the inner ends of the shafts, while the stop-arms C^3, C^4 are secured to the inner ends of sleeves 36, 37 loosely mounted on the shafts but held against longitudinal movement thereon by collars 38.

The stop-arms are oppositely arranged, that is to say, stop-arms C' and C^3 on shaft 33 and sleeve 36, respectively, are normally held in front of the path of movement of the abutment 31, with which they coöperate to arrest the movement of the corresponding shifter, while the stop-arms C^2 and C^4 on shaft 34 and sleeve 37 lie inside of the path of abutment 20. Operating electro magnets E' and E^3 are arranged upon the support 32 above the shafts 33 and 34 and their armatures are carried upon arms d' and d^3 secured respectively to and extending upwardly from the outer ends of the shaft 33 and the sleeve 36. Electro magnets E^2 and E^4 are arranged below the shafts and their corresponding armatures are mounted upon downwardly projecting arms d^2 and d^4 secured respectively to the outer ends of the shaft 34 and sleeve 37.

The stop-arms are similarly constructed and each corresponds to upper and lower sections 39 and 39′. The lower sections 39′ have hub portions 40 secured to the corresponding operating shaft or sleeve, while the upper sections 39 of each arm has a laterally projecting stop-lug 41 at its upper end. The upper and lower sections are adjustably connected together by pin-and-slot connection 42, and screws 43 connected to ears 44 upon the upper section and threaded through ears 45 upon the lower section, serve to properly position the stop-lug 41 at the outer end of the stop-arm. The hubs of the several stop-arms are provided with downwardly extending lugs 46, between which extend tension springs 47.

By selectively controlling the energizing circuits of the electro magnets E', E^2, E^3 and E^4, the outer stop-arms C' and C^3 may be shifted inwardly and the stop-arms C^2 and C^4 shifted outwardly against the tension of springs 47, to bring the corresponding stop-lugs 41 at their upper ends into the path of movement of the shifter operated by the solenoid B. The stop-lugs 41 are located at different distances below the ends of the shifter so as to variably arrest the rotation of the type wheel.

The stops D', D^2, D^3 and D^4 and their operating magnets F', F^2, F^3 and F^4 are similar in construction and arrangement and coöperate with the shifter operated by the solenoid B′ to variably limit the rotation of the type wheel in the opposite direction. By the arrangement of the solenoids B and B′, the corresponding shifters and sets of stops, the type wheel may be rotated in opposite directions from normal to select any one of the longitudinal row of type thereon.

The energizing circuits of the solenoids B and B′ are preferably controlled, each by the corresponding sets of stops or the operating circuits therefor For this purpose, pairs of normally open spring-contacts 48 and 49, mounted upon but insulated from lugs 50 on the supports 32 are interposed respectively in the energizing circuits of the solenoids B and B′. Each pair of spring-contacts extends between the corresponding set of stop-arms so that when any one of them is shifted, the circuit through the corresponding solenoid is also closed. The contacts 48 and 49 are provided with insulating strips 48′ and 49′ against which the stop-arms strike. It is therefore only necessary to selectively control the energizing circuits of the stop-actuating magnets to rotate the type wheel to desired position.

The lateral shift of the type carrier or wheel is effected in the form shown in Fig. 1 by a pair of electro magnets or solenoids G, G′, arranged horizontally and in line as shown, and secured at their inner ends to a U-shaped piece 51 which, in turn is mounted upon an upright projection or lug 52 at the upper edge of the frame plate *a*. Lug 52 is offset toward the front and solenoids G, G′ are as shown, arranged in front of the racks and pinions by which the type wheel is rotated.

The solenoids G, G′ are alike and each comprises a spool 53, surrounded by a rectangle 54 of soft iron. A core-piece 55 common to both solenoids, is arranged to slide within the inner ends of a pair of cylinders or tubes 56 of brass or other suitable non-magnetic material arranged within the solenoid spools, as shown and projecting beyond the outer ends thereof. A shifter-arm 57 fixed to the central portion of the core 55 and projecting rearwardly and upwardly therefrom, has a slotted or forked end engaging a grooved collar 58 on the type wheel. By energizing one or the other of the solenoids G or G′, the type wheel may be shifted laterally in opposite directions from normal.

The type wheel and the lateral shifter therefor, are yieldingly held in central position between a pair of spring-held stops 59 (see Fig. 2^a), similar in all respects to the stop-plungers 27. These stops or stop-plungers 59, are arranged within the tubes 56, engage the opposite ends of the shifting core 55, and are yieldingly held in position to center the type wheel in lateral direction by springs 60, coiled about the stems of the stop-plungers and extending between the heads thereof and the cap-pieces 61 threaded over the ends of the tubes 56. Thumb-nuts 62 adjustably threaded upon the stems of the stop-plungers, engage the cap-pieces 61, limit the inward movement of the plungers and hold them in normal position. By adjusting the cap-pieces 61 and nuts 62, the positions of the stop-plungers 59 are properly adjusted to securely hold the type wheel in central position and take up all lost play or "back lash" between the parts.

The extent of lateral shift of the type wheel is limited in one direction by the set of stops H, H′ and in the opposite direction by the set of stops J, J′, the stops being arranged to engage abutments 63 adjustably threaded upon the projecting ends of the stem of the stop-plungers 59. Both sets of stops and the controlling devices therefor, are similar in construction and mounted upon supporting plates 64, which are fixed to the upper, front portion of the frame plate *a*. Stop H is fixed to the support 64, but stop H′ is in the form of a shiftable arm. The latter is provided with a laterally projecting stop-lug 65 on its end normally out of the path of the adjacent abutment 63, but arranged to shift into position between the abutment and the stop H. Stop-arm H′ is mounted upon a rock-shaft 66, journaled between a pair of brackets or lugs 66′ on the support 64, and provided with a laterally projecting arm 65′ to which the armature of the operating magnet K is secured. Magnet K is mounted as shown upon the support 64.

A pair of normally open spring contacts 67 are mounted upon but insulated from the supporting plate 64 in the path of movement of the stop-arm H′, so as to be shifted to closed position when the electro magnet K is energized. These contacts are interposed in the energizing circuit of the adjacent solenoid G, which serves to shift the type laterally.

The stops J, J′ and the operating magnet L for the stop-arm J′, are similarly constructed but are oppositely arranged to variably arrest the lateral shift of the type wheel in the other direction. Stop-arm J′ is arranged to engage and close a pair of normally open spring-contacts 68 interposed in the energizing circuit of the solenoid G′. The contacts 67 and 68 are provided with insulating pieces 69 against which the stop-arms H′ and J′ strike.

By closing the energizing circuit of one or the other of the solenoids G or G′, the type wheel may be shifted laterally in one or the other direction until arrested by the stop H or J. If either of the magnets K or L is energized, either the stop H′ or J′ is operated, the circuit through the adjacent solenoid G or G′ is closed and the type wheel is shifted laterally as before in one or the other direction, but is arrested by the engagement of one of the abutments 63 with the stop-lug 65 upon either one of the stop-arms H′ or J′. By this means, the type wheel may be quickly shifted endwise in opposite directions from normal and its shift is variably arrested by the stops to bring any one of the lateral rows of type upon the wheel to printing position.

At the top of the frame plate *a* is arranged a horizontal platform or top plate 70, which extends rearwards, as shown in Fig. 3. An upright portion 71, at the extreme rear of the platform 70, carries the printing hammer M and the operating magnet N therefor. The printing hammer M is upon the arm of a bell crank 72, arranged to swing in a horizontal plane upon a pivot 73, which is carried upon a horizontal support 74, projecting forwardly from the upright 71.

The actuating magnet N is preferably in the form of a solenoid and is carried by horizontally arranged U-shaped support 75′ fixed to the outer end of the upright 71 and forwardly projecting therefrom. This solenoid comprises a spool 75 surrounded by a rectangular piece 76 of soft iron and provided with a shifting core-piece 77. The inner end of the core-piece or shifter 77 is provided with a fixed collar 78 and a loose collar 79, between which extends the forked end of the short arm of the bell crank 72. Collar 79 is yieldingly held in position by a coiled spring 80 which extends between the collar and a nut 81 adjustably threaded upon the end of the shifter 77. A lock nut or stop-member 82, having a rounded outer end is threaded upon the extreme end of the shifter 77 and holds nut 81 in adjusted position. A stop screw 83 is adjustably threaded through a stud 84, projecting forwardly from the upright 71 and is arranged in the path of the stop-member 82.

When the solenoid N is energized, the core-piece or shifter 77 is actuated to move the hammer M toward the type wheel A. The stop-member 82 upon the shifter is arranged to engage the stop-screw 83, before the hammer strikes the wheel. The hammer is however, not arrested but the spring-held collar 79 permits it to continue its movement under the influence of the momentum acquired until the blow upon the type at the printing point is struck to effect the impression thereof upon the paper. The blow is thereby rendered sharp and quick.

Each of the shifters of the solenoids B, B′, which rotate the type wheel, is also arranged to close the energizing circuit of the solenoid N which operates the printing hammer. For this purpose, a pair of normally open spring-contacts 85 (see Fig. 1) are mounted upon an arm 86, but are insulated therefrom as shown. Arm 86 is pivoted to the lug 50 on the supporting plate 32. A spring 87 extending between the end of the arm 86 and the plate 32 holds the free ends of the contacts into engagement with the stop-member 31 on the lower end of the shifter of the solenoid B and above the set of stops C′, C^2, C^3 and C^4. Whenever any one of the latter and the shifter of solenoid B are operated, the contacts 85 and arm 86 are swung about the pivot of the arm until arrested by the engagement of the free ends of the contacts with the selected stop. The contacts are then brought into engagement to close the energizing circuit of the solenoid N and to operate the printing hammer M. The free ends of the contacts 85 are provided with insulating strips 88 with which the stop-members 31 on the shifter of solenoid B and the stop-lugs 41 of the arms C′, C^2, etc. engage.

A pair of contacts 89 similar in construction and arrangement are interposed in the circuit of solenoid N and coöperate in a similar manner with the shifter of solenoid B′ and the set of stops D′, D^2, D^3 and D^4.

A pair of normally closed spring-contacts 90 (see Figs. 2 and 2^b) are mounted upon but insulated from the rectangular piece 76 of the solenoid N. A bell crank 91 is pivotally connected to a bracket 92 upon the outer end of rectangular piece 76. One end of the bell crank is forked and extends between a pair of collars 93, adjustably threaded upon the outer end of the shifting core-piece 77, and its opposite end is arranged to engage one of the spring-contacts 90, and break the engagement thereof, whenever the printing hammer actuating solenoid is energized.

Contact-springs 90 are interposed in the energizing circuit leading to the operating magnets and solenoids, so that as soon as the impression of the selected type is made, the circuit is broken and the several magnets and solenoids are deënergized to permit the return of the shifted parts to normal position. The type wheel is quickly returned to normal by the spring-actuated stop-plungers 27 and 59.

The paper upon which the messages are recorded is carried in the rear of the type wheel A, and intermediate the same and the printing hammer M, upon a carriage O (indicated in dotted lines in Fig. 3) arranged to slide transversely upon the platform 70. The paper carriage may be of any suitable construction, and any suitable means may be employed for shifting the same laterally or in letter-space direction step-by-step at each operation of the printing mechanism. So too, the paper carriage may be provided with any suitable form of paper feed mechanism to properly form the spaces between the lines of printed matter.

It will be observed that the mechanism for rotating and laterally shifting the type wheel, is entirely in front of the wheel and in front of the supporting platform 70, and that the printing hammer is mounted above the path of movement of the carriage upon the upright 71 at the rear of the platform. Ample space is thus provided for the laterally shiftable paper carriage. Moreover, the paper P (see Fig. 3) is held in vertical position at the rear of the type wheel and in front of the horizontally arranged printing hammer, so that the message may be conveniently read as soon as it is recorded by any one in front of the machine.

A diagram of the operating circuits is illustrated in Fig. 7. The several operating magnets and solenoids derive current from a local battery 94 and are connected on one side thereto by a series of branches and a common return conductor 95, indicated by heavy lines in the diagram. The operating magnets and solenoids are connected to a number of branch conductors numbered 1 to 12 inclusive and 15. Any suitable arrangement of electric selecting means may be arranged to close the circuit from the local battery 94 through the several branch conductors, the electric selecting means being in turn controlled by the line circuit. One form of such selecting means is illustrated diagrammatically in Fig. 8 and will be hereinafter described.

A power wire or conductor 96 leads from the local battery 94 to the electric selector means and back through one of the branches and one of the magnets or solenoids in accordance with the operation of the selector means. The normally closed spring-contacts 90 are interposed in the conductor 96 as shown. The circuit is first closed through one of branches 1, 2, 3 or 4, leading respectively to the solenoids G′, magnet L, magnet K and solenoid G. If the circuit is closed directly by branch 1 into the solenoid G′, the type-wheel is shifted to the left until arrested by the engagement of the stop-member 63, with the stop J. By closing the circuit through branch 2, and magnet L, stop J′ is shifted into the path of the stop-member 63, and moves contacts 68 into engagement. A circuit is then closed from battery by power wire 96, conductor 97, contacts 68, conductor 98 and branch 2 through the solenoid G′, and back to battery through the return conductor 95. The type-wheel is then shifted to the left but is arrested by the engagement of the stop-member with the stop J′, which is then in front of the stop J. The circuit through conductor 2, thus not only controls the operation of stop magnet L, but also controls the operation of the shifter magnet or solenoid G′. In a similar manner, the type-wheel may be shifted to different extents to the right, or until the stop-member 63 engages either the stop H or the stop H′, by closing the circuit through the branch 3 or branch 4 to engage the magnet K or the solenoid G. When magnet K is operated to shift stop H′ into the path of the stop-member 63, contacts 67 are brought into engagement and a circuit may be traced from battery by conductors 96, 99, and 100 to contacts 67, thence by conductor 101 to solenoid G and back to battery by return wire 95. In this way, the type-wheel may be shifted one or two steps to the right or left, to bring any one of the four rows of type thereon in line with the printing point, and to bring any one of four letters in the longitudinal row of type beneath the printing hammer to the printing point. If one of the four type in this row is desired, the hammer M is operated directly after the side shift of the wheel, by closing the circuit through the branch 15 and solenoid N, to effect the impression of the selected type upon paper. If one of the type to be brought to the printing point is in one of the other longitudinal rows, the type wheel must be rotated after the side shift, by closing the energizing circuit through one of the branches 5, 6, 7, 8, 9, 10, 11, 12 and through one of the stop-actuating magnets E′, E², E³, E⁴, F′, F², F³ or F⁴, which are respectively connected to the several branches on one side and to the return conductor 95 upon the other. Branches 5, 6, 7, and 8 also control solenoid B′, since whenever one of the set of magnets F′, F², F³ and F⁴ is energized, one of the stops D′, D², D³ or D⁴ is shifted into the path of the stop-member 31 to arrest the movement of the shifter actuated by solenoid B′, the shifted stop also moves contact 49 into engagement and closes the energizing circuit of solenoid B′ as follows, from battery by power wire 96, conductor 101, contacts 49, conductor 102, through the coil of solenoid B′ and back to battery by return conductor 95. So that the type wheel is rotated in one direction and variably arrested to bring the selected type to the printing point. In a similar manner magnets E′, E², E³ and E⁴ operate to shift any one of the set of stops C′, C², C³ or C⁴ into the path of the corresponding stop-member 31 to limit the movement of the shifter of solenoid B and shift contacts 48 into engagement to close the circuit through solenoid B, as follows;—from power wire 96, conductors 99 and 103, contacts 48, conductor 104 to the coil of solenoid B and back to the battery by return conductor 95. By this means, the type wheels may be variably rotated in the opposite direction.

By combining the lateral and rotary movement of the type wheel, any character thereon may be brought to the printing point. When solenoid B′ is energized contacts 89 are brought into engagement and a current may be traced from power wire 96, by conductors 105, contacts 89, conductor 106 and branch conductor 15 to the coil of solenoid N and back to battery by return conductor 95, so that the printing hammer M is shifted to effect the impression of the selected type. Similarly, the shifter of solenoid B moves contacts 85 into engagement to close the printing hammer circuit as follows:—from power wire 95, by conductors 99 and 107 to contacts 85, conductor 108 and branch conductor 13 through the coil of solenoid N as before. In this form, the type wheel may be shifted laterally to the right or left one or two steps, to bring any one of four transverse rows of type in line with the printing hammer, and rotated in one or the other direction, one, two, three or four steps to bring any one of eight longitudinal rows of type to the printing point. The longitudinal row of type in line with the hammer may also be utilized, so that the type wheel may be provided with thirty-six characters in all. The number of stops for variably arresting the rotation and lateral shift of the type wheel, may of course be varied as desired, so that more or less characters may be employed. Whenever the printing hammer solenoid N is energized, contacts 90 are disengaged by the shift of bell crank 72 and the power circuit is broken at this point so that all parts may quickly return to normal position and are ready to record the succeeding character.

In the form shown in Fig. 6, the type wheel A′ is similarly mounted upon a shaft b' at the upper portion of the frame plate a, and is arranged to rotate with the shaft and shift laterally thereon. The rotation of the type wheel in opposite directions is effected by a horizontal shifter arm 109, carried upon a pivot 110 at the upper end of a standard 111. Standard 111 is mounted as shown, upon a horizontal supporting plate 112 fixed to the upright frame plate A. A toothed segment 113 is mounted upon a short rock shaft 114 carried between the upright a^2 and a second upright a^3 upon the frame. Segment 113 meshes with the teeth of a pinion 115 upon the type wheel shaft b' and is connected by a link 116 with the shifter 109. A pair of magnets B^2, B^3 are mounted upon the support 112 on opposite sides of the standard 111 and the armatures of these magnets are fixed to the shifter 109 on opposite sides of its pivot. By energizing one or the other of said magnets, the type wheel may be rotated in one or the other direction. The type wheel A is held in normal central position by a pair of stop-plungers 117, arranged within vertical guide cylinders or tubes 118 mounted upon the support 112. The stems of the stop-plungers extend through plugs 119 adjustably threaded into the upper ends of the tubes 118, and also extend loosely through slots in the shifter-arm 109. Stop nuts 120 are adjustably threaded upon the upper ends of the stems of the stop-plungers and engage the upper edge of the shifter-arm. Lock-nuts 121 hold the stop-nuts 120 in place. The stop-plungers, shifter-arm and type-wheel are yieldingly held in place against bottom plugs 119′ in cylinders 118 by springs 122, coiled about the stems of the stop-plungers 117 and extending between the heads thereof and the plugs 119. By adjusting the latter, springs 122 may be placed under proper tension. By properly adjusting the stop-nuts 120, all loose play or "back lash" between the parts may be taken up and the shifter-arm 109 and type-wheel A accurately held in central position. The sets of stops C', C^2, C^3 and C^4 and the stops D', D^2, D^3 and D^4 for variably limiting the extent of rotation of the type wheel in either direction, are entirely similar in construction and mode of operation to those employed upon the form shown in Fig. 1, and are arranged on opposite sides of the projecting end of the shifter arm 109 to limit its movement in either direction. The contacts 48, arranged to be closed by any one of the stops C', C^2, C^3 or C^4 are interposed in the circuit of magnet B^2 and contacts 49 controlled by the stops D', D^2, D^3 and D^4 are interposed in the circuit of magnet B^3. In this form however, additional stationary stops C^5 and D^5 are fixed to the supports 32, respectively, below and above the sets of movable stops and by closing the energizing circuits by either magnet B^2 or magnet B^3, independently of the shiftable stops, the arm 109 may be moved in one or the other direction into engagement with one or the other of the stationary stops C^5 or D^5. The pairs of contacts 85 and 89, for closing the printing hammer circuit, are held by the springs 87, into engagement with the end of the shifter-arm 109, so that this circuit is closed whenever the arm is moved in either direction.

The printing hammer, operating means therefor and paper-carrying means in rear of the type wheel (not shown in Fig. 6) is entirely similar in construction and arrangement to that already described. In this form, the type wheel may be rotated in one or the other direction, one, two, three, four or five steps, and, since the row of type in line with the printing hammer may be utilized, the type wheel may be provided with eleven longitudinal rows of type. The type wheel in this form, is shifted laterally in one direction only. Shifter 55 and solenoid G' for moving the type wheel laterally toward the left, are entirely similar in construction and arrangement to that previously described, except that the type wheel and shifter are held against movement toward the right from normal position by a stop-screw 122 adjustably threaded through a lug 123 on the bracket 51.

Stops J, J' for limiting the shift of the type wheel to the left are similar to those previously described. An additional movable stop-arm J^2 is provided, having its stop lug 65 in advance of that on the stop-arm J'. This stop-arm is secured to a shaft 66^a journaled in lugs 66′ and 67′ and extending through a slot in the stop-arm J'. The armature of a magnet L' is fixed to an arm 68′ on the shaft 66^a so that the stop J^2 is shifted into the path of the stop-member 63 when magnet L' is energized. Stop-arms J' and J^2 are arranged to close the energizing circuit of the solenoid G' by shifting the contacts 68 into engagement in the manner previously described. By this means, the type wheel may be shifted to the left, one, two or three steps, and as the transverse row of type in line with the printing hammer may be utilized, the type wheel may have four transverse rows of type as shown. As there are eleven longitudinal rows, forty-four characters may be employed, any one of which may be brought to the printing point by properly combining the lateral and rotary movements of the type wheel.

A diagram of the operating circuits is illustrated in Fig. 8. As before, the current is derived from a local battery 94 to which the several operating solenoids and magnets are connected on one side by the branched return conductor 95 indicated by heavy lines. On the other side, the several solenoids and magnets are connected to a set of branches, (numbered 2 to 15 inclusive) which are controlled by suitable electric selective means. A power wire 96 leads from the battery to the electric selective means and back through any one of the set of branches in accordance with the operation of the selector controlling means. If the character to be selected, is not in the transverse row of type in line with the printing hammer M, the circuit is first closed through one of the branches 2, 3 or 4 which lead respectively through the solenoid G' and magnets L and L'. If the circuit through branch 2 and directly through solenoid G' is closed, the type wheel is shifted to the left until stop-member 63 engages the fixed stop J and the fourth transverse row of type is brought to the printing point. If the circuit is closed through branch 3 or 4 and magnet L or L', either one of the stops J and J' is shifted into the path of stop-member 63. At the same time contacts 68 are brought into engagement and the circuit through the solenoid G' is closed, as previously described, from power wire 96, by conductor 97, contacts 68 conductor 98 and branch conductor 2, and the type wheel is shifted to the left to bring either the second or third transverse row of type in line with the printing hammer. After the side shift of the type wheel, it is rotated to bring the desired type to the printing point by closing the energizing circuit through one of ten of the branches, number 5 to 14 inclusive. The branch circuits numbered 5 to 12 as before, are arranged to selectively operate the sets of stops D', D^2, D^3 and D^4 and the set of stops E', E^2, E^3 and E^4 which, when shifted, close the circuits respectively through the magnet B^2 and B^3 and coöperate with the shifter-arm 109 to variably arrest the movement of the type wheel as it is rotated in one or the other direction, one, two, three or four steps to bring the selected type to the printing point. Branches 13 and 14 are arranged to close the circuit directly through the type wheel rotating magnets B^2 and B^3 (without first actuating any of the movable stops) so that the wheel may be rotated in one or the other direction five steps until arrested by the engagement of the shifter-arm 109 with one or the other of the fixed stops C^5 or D^5. As before, the shifter mechanism for rotating the type wheel coöperates, when actuated, with the contacts 85 or 89 to close the hammer operating circuit through the solenoid N. One of the type on wheel A' lies at the printing point, and to effect the impression of the type, the circuit is closed through branch 15 and directly through the hammer-actuating solenoid N. If the type to be selected lies in the longitudinal row in line with the hammer, the wheel is first shifted laterally to bring the same to the printing point and the circuit is then closed directly through branch 15 and solenoid N to operate the printing hammer without rotating the type wheel. If the character is in the transverse row of type in line with the printing point, the wheel is rotated to the proper extent, without first shifting the same endwise and the hammer actuating circuit is automatically closed as before by the shifter 109. The other characters must be brought to the printing point by continuing the laterally and rotary movements. Thus one character may be printed without shifting the type wheel at all, thirteen by variably shifting the wheel with one movement only and the remainder of the forty-four characters by combining the two variable movements in different directions. The variable shifts moreover, are not step-by-step but the type wheel is quickly moved by a single throw in one and the other direction. Moreover, no time is lost in restoring the parts to normal position, since as soon as the printing hammer is actuated the contacts 90 are disengaged to open the circuit through the several operating magnets and all shifted parts are instantly returned to normal position by their restoring springs. The type wheel may thus be operated with great rapidity and certainty to record the succeeding characters of the message.

Various means may be employed to selectively control the flow of current through the several branch conductors 1 to 15 inclusive. The selective means in turn is controlled by the line circuit over which the messages are transmitted, the various characters being represented by variably modifying the circuit impulses over the line in keeping with a suitable code.

In Fig. 7 is illustrated one arrangement of electric selector means which may be employed. In this arrangement, the line circuit 125 extends from the transmitting station, through a set of relays 126, at the receiving station, and then to ground. These relays respond differently to the varied line impulses, for example, to strong positive and negative and weak positive and negative impulses respectively, as indicated. The armatures of the first and second relays which respond to the strong impulses are connected to battery 94 by a conductor 127, and the armatures of the third and fourth relays are connected to the back contacts of the first and second relays by conductors 128. A set of conductors 130 are connected to the front contacts of the several relays and are selectively connected to the battery or other source of power by the operation of the relays 126 in response to varied line impulses. The set of conductors 130 are connected to a set of transfer switches 131, to the back contacts of which a set of branch conductors 132 are connected, so that the conductors 130 are normally connected at this point at the branches 132. A relay 133 having oppositely wound coils or coil sections, is arranged to actuate the transfer switches 131, at the end of the first line impulse to shift the connection of the conductors 130 from the branch conductors 132 to a set of conductors 134, which are connected to the first contacts of the switches 131. In each of the branch conductors 132 is arranged a relay 135, and each relay is arranged to actuate a switch-arm 136 and a second locking switch-arm 137. In this arrangement of selecting means, each character is represented by three modified line impulses. At the first line impulse, the circuit may be traced from battery 94, by conductor 127 to the armature of one of the line relays 126 (operated in accordance with the character of the line impulse) to one of the conductors 130, and one of the branches 132 and the corresponding relay 135, thence by a conductor 138 and a conductor 139 (common to all of the relays 135) through one of the coils of transfer switch relay 133 and back to battery by return wire 95. One of the switches 137 then actuated, closes a circuit from battery wire 96, conductors 140, 141, switch 137, conductor 142, through the coil of the magnet 135, which has been energized and by a common conductor 143 through the opposite coil of transfer switch relay 133 and back by return wire 95. The shifted switches 136 and 137 are thus locked in shifted position after the first line impulse has ceased.

The circuit is closed through the oppositely wound coils of transfer switch relay 133 before it can operate, and as the coils balance each other, the switches 131 are not moved until the cessation of the first line impulse opens the circuit through the branch conductor 132 and one of the coils of the relay 133. Switches 131 are then shifted to change the connection of the conductors 130 from the branches 132 to the set of conductors 134, and the transfer switches, together with the selected switches 136 and 137 are locked in shifted position.

The set of switches 136, selectively control the branch circuits 1, 2, 3 and 4 leading to the operating path of the printing mechanism. The selected switch 136, closes a circuit from battery wire 96, conductors 140 and 141, selected switch 136 and one of the branches 1, 2, 3 or 4, to effect the side shift of the type wheel. The form of printing apparatus shown in Figs. 6 and 7 does not utilize branch 1, controlled by the first relay 135, so that if the wheel is not to be shifted laterally, the first line impulse selects this relay and merely serves to operate the transfer switches 131.

The set of conductors 134 lead to a second set of transfer switches 144 to the back contacts of which a set of branch conductors 145 are connected. A relay 146 having oppositely wound coils or coil sections, is arranged to shift the switches 144 at the cessation of the second line impulse to change the connections of the conductors 134 from branch conductors 145 to the branches 147 (three in number) which are connected to the front contacts of the transfer switches 143. In each of the branch conductors 145 is arranged a magnet 148, each controlling a set of switches. The first magnet 148 is arranged to operate the set of switches 149, and the second, third and fourth magnets respectively operate the sets of switches 150, 151, and 152. There are three switches as shown in each of these sets and they control the flow of current through the branch conductors 5 to 15 inclusive, which lead to the operating parts for effecting the rotation of the type wheel and the independent operation of the printing hammer. Each magnet is also arranged to operate a locking switch 153.

At the second line impulse, the local operating circuit is closed as follows:—from battery 94 by conductor 127, to the armature of one of the line relays 126, thence by one of the conductors 130, the corresponding switch 131, conductor 134 and switch 144, to one of the branch conductors 145, through the coil of the corresponding magnet 148, conductor 154 and common conductor 155 through one of the coils of transfer switch relay 146, and by return conductor 96 to battery. One of the sets of switches 149, 150, 151 or 152 corresponding to the selected magnet 148 is then shifted and locked in shifted position by the operation of the corresponding locking switch 153. The latter closes a circuit as follows: from battery wire 96 by common conductor 157, conductor 158, the selected locking switch 153, conductor 159 through the coil of the selected magnet 148, by conductor 160, and common conductor 161 through the opposite coil of transfer switch relay and back to battery as before by conductor 95. The opposite coils of transfer switch relay 146 are thus both energized, and, as they balance each other, the relay is not actuated until the cessation of the second line impulse. At this time, the circuit through one of the coils of relay 146 is opened and transfer switches 144 are actuated to shift the connection of the conductors 134, from the set of branches 145 to the set of branches 147. The locking circuit controlled by the shifted locking switch 153 is held however, in closed condition through the selected magnet 148 and through one of the coils of relay 146, so that one of the sets of switches 149, 150, 151 and 152, and the set of transfer switches 144 are shifted and locked in shifted position by the second line impulse of the signal.

Each one of the three branch conductors 147 is connected as shown to one of the three switches in each of the sets 149, 150, 151 and 152. As stated, each character is represented by three line impulses. At the third line impulse, the local circuit is closed as follows: from battery 94 by conductor 127, the armature of one of the line relays 126, one of the conductors 130, through the corresponding switch 131, conductor 134 and switch 144 to one of the branch conductors 147, thence to one of the switches in that set 149, 150, 151 or 152, which have been previously selected and shifted by the second line impulse, and thence to one of the branches 5 to 15 inclusive, and through the operating parts of the machine, as previously described.

As above stated, branches 5 to 12 inclusive, control the stop-actuating magnets which effect the variable rotation of the type wheel. Branches 13 and 14 directly control the type wheel rotating magnets B^2 and B^2 without first operating the one of the stop magnets. If it is not necessary to rotate the wheel to bring the desired type to the printing point, the circuit is directly closed through branch 15 and hammer actuating magnet N.

The controlling circuit through the selecting means as well as through the printing apparatus, is broken as soon as the printing hammer is actuated to disengage the contacts 90 in battery wire 96, and all parts are immediately returned to normal position, and are ready to receive the succeeding signal and record the character corresponding thereto. This same selector means could be employed to control the operation through the set of branches which govern the operation of the printing mechanism diagrammatically illustrated in Fig. 7. The controlling branch conductors are correspondingly numbered in Figs. 7 and 8.

The particular electric selector means set forth forms no part of the present invention, and other arrangements may be employed for selectively controlling the flow of current through the set of conductors leading to the operating parts of the printing mechanism.

It is obvious that numerous changes may be made in the details of structure and arrangement of parts without departure from the essentials of the invention. For example, the type-wheel or carrier may be segmental in form, if desired.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In printing telegraphs, a type-carrier having a plurality of rows of type, operating shifters arranged to move said type carrier in different directions at an angle to each other, stop devices arranged to variably arrest the movement of said type-carrier in either direction, electric selective means controlling the operation of said stop devices, and means for operating said shifters controlled by said stop devices.

2. In printing telegraphs, a type-carrier, a shifter therefor, an electro magnet for operating said shifter, stop devices for variably arresting said type-carrier and shifter, an energizing circuit for said electro magnet controlled by said stop devices and electric selective means controlling the operation of said stops.

3. In printing telegraphs, a type-carrier having a plurality of rows of type movable in different directions at an angle to each other, operating shifters for said type-carrier, separate sets of movable stops for variably arresting the movements of said type-carrier in either direction, operating electro magnets for said shifters and for said stops, electrical means selectively controlling the energizing circuits of said stop actuating magnets, and means operated by said stops controlling the circuits of said shifter operating magnets.

4. In printing telegraphs, a type-wheel having a plurality of rows of type, separate shifters arranged to rotate and laterally shift said type-wheel, sets of stops for variably arresting the rotating and lateral shift of said type-wheel, operating electro magnets for said shifters and for said stops, electric means selectively controlling the operation of stop-actuating magnets and means controlled by said stop actuating magnets for energizing said shifter operating magnets.

5. In printing telegraphs, a type-carrier, a shifter there-

for, an operating electro magnet for said shift, a set of stops arranged to variably arrest the movement of said shifter, a normally open switch in the energizing circuit of said electro magnet arranged to be shifted to closed position by each of said stops, operating electro magnets for said stops and electrical means selectively controlling the energizing circuits of said stop actuating magnets.

6. In printing telegraphs, a type-wheel having a plurality of rows of type, shifters for rotating and laterally shifting said type wheel, operating electro magnets for said shifters, normally open spring-contacts in the energizing circuits of said electro magnets, sets of stops arranged to variably arrest the rotation and lateral shift of said type-wheel, and to shift said contacts to closed position, and electric selective means controlling the operation of said stops.

7. In printing telegraphs, a type-carrier, a shifter therefor, stop devices arranged to variably arrest the movement of said shifter, operating electro magnets for said shifter and said stop devices, a switch in the energizing circuit of said shifter magnet controlled by the operation of said stop devices, a printing hammer, an operating electro magnet therefor, a switch in the circuit of said hammer magnet controlled by the operation of said shifter, and electric means selectively controlling the energizing circuits of said stop-actuating magnets.

8. In printing telegraphs, a type-carrier, a shifter therefor, stop devices arranged to variably arrest the movement of said shifter, operating electro magnets for said shifter and said stop devices, a switch in the energizing circuit of said shifter magnet controlled by the operation of said stop devices, a printing hammer, an operating electro magnet therefor, a switch in the circuit of said hammer magnet controlled by the operation of said shifter, electric means selectively controlling the energizing circuits of said stop-actuating magnets, means for locking said circuits in closed condition and a normally closed unlocking switch arranged to open by the operation of said hammer-actuating magnet.

9. In printing telegraphs, a type-carrier, a shifter therefor, a fixed and a movable stop for variably arresting the movement of said shifter, operating electro magnets for said shifter and said movable stop, electrical selective means for closing the energizing circuit of either of said magnets and a switch in the circuit of said shifter magnet controlled by the operation of said movable stop.

10. In printing telegraphs, a type-carrier, a pair of spring-held stops yieldingly holding said type-carrier in central position, shifter mechanism for moving said type-carrier in opposite directions from normal against the resistance of one or the other of said yielding stops and selector mechanism controlling the movement of said shifter and type-carrier.

11. In printing telegraphs, a type-carrier, a pair of oppositely arranged stops by which said type-carrier is held in central position, springs yieldingly holding said stops in position, shifter mechanism for moving said type-carrier in opposite directions from normal against the resistance of one or the other of said yielding stops, stop devices for variably limiting the movement of said type-carrier and controlling electric selective means for said devices.

12. In printing telegraphs, a type-carrier, a pair of oppositely arranged stops by which said type-carrier is held in central position, springs yieldingly holding said stops in position, means for adjusting the normal position of said stops, shifter mechanism for moving said type-carrier in opposite directions from normal against the resistance of one or the other of said stops, stop devices for variably arresting the shaft of said type-carrier and controlling electric selector means for said stop devices.

13. In printing telegraphs, a type wheel yieldingly spring held in central position, shifter mechanism for rotating said wheel in opposite directions from normal, separate shifter mechanism for axially moving the type wheel in opposite directions, stop devices for variably arresting the rotary and axial shift of said type wheel and electro selective means controlling the operation of said stop devices and shifter mechanism.

14. In printing telegraphs, a type-wheel, shifter mechanism for rotating said type-wheel, a pair of oppositely arranged yieldingly spring-held stops holding said shifter mechanism and type-wheel in central position, a pair of electro magnets for actuating said shifter mechanism and type-wheel in opposite directions from normal, sets of stops for variably arresting the movement of said shifter mechanism and type-wheel, electro magnets for operating said stops and electrical means selectively controlling the energizing circuits of said shifter and stop magnets.

15. In printing telegraphs, a type-wheel having a plurality of rows of type, separate shifter mechanisms arranged to respectively laterally shift and rotate said type-wheel, operating magnets for said shifter mechanisms, separate sets of stops for variably arresting the lateral shift and rotation of the type-wheel, magnets controlling the operation of said stops and electric selective means controlling the energizing circuits of said shifter and stop-actuating magnets.

16. In printing telegraphs, a type-wheel having a plurality of rows of type, separate shifter mechanism arranged to respectively laterally shift and rotate said type-wheel, operating magnets for said shifter mechanism, separate sets of stops for variably arresting the lateral shift and rotation of the type-wheel, magnets controlling the operation of said stops, means for closing the energizing circuits of said shifter magnets controlled by said stops and electric selective means controlling the energizing circuits of said stop actuating magnets.

17. In printing telegraphs, a type-wheel having a plurality of rows of type, separate shifter mechanism arranged to respectively laterally shift and rotate said type-wheel, operating magnets for said shifter mechanism, separate sets of stops for variably arresting the lateral shift and rotation of the type-wheel, magnets controlling the operation of said stops, means for closing the energizing circuits of said shifter magnets controlled by said stops, a printing hammer, an actuating circuit therefor controlled by one of said shifter mechanisms and electric selective means controlling the energizing circuit of said stop-actuating magnets.

18. In printing telegraphs, a type-carrier, an operating solenoid, a shifter for said type-carrier forming the core of said solenoid and longitudinally shiftable therethrough, a set of stops for variably limiting the throw of said shifter and type-wheel and selector mechanism controlling the operation of said solenoid and arresting stops.

19. In printing telegraphs, a type-carrier, an operating solenoid, a shifter for said type-carrier forming the core of said solenoid and longitudinally shiftable therethrough, a spring-held yielding stop engaging said shifter against the resistance of which said shifter is moved and by which said shifter and type-wheel are held in normal position, means for variably limiting the throw of said shifter and type-carrier and controlling electric selective means therefor.

20. In printing telegraphs, a type-carrier, an operating solenoid, a shifter for said type-carrier forming the core of said solenoid and longitudinally shiftable therethrough, a tube extending through said solenoid within which said shifter is guided, a spring-held yielding stop-plunger within said tube and engaging the end of said shifter to hold the same and said type-wheel in normal position, means for adjusting the position of said stop-plunger within said guide tube, and selectively controlled stop mechanism for variably limiting the throw of said shifter and type-carrier.

21. In printing telegraphs, a type-wheel, shifter mechanism for rotating said type wheel in opposite directions, a pair of stops engaging said shifter mechanism to hold said type-wheel in normal, central position, means for adjusting the normal positions of said stops, springs yieldingly holding said stops in normal position, a pair of magnets arranged to actuate said shifter mechanism respectively in opposite directions, and selectively controlled stop devices for variably limiting the movement of said shifter mechanism and type-wheel.

22. In printing telegraphs, a type-carrier, shifter mechanism for moving said type-carrier in opposite directions from normal position, a pair of spring-held stops arranged to hold said shifter mechanism and type-carrier in central position, each of said stops being held against movement in one direction but arranged to yield in opposite direc-

tions to permit the opposite shift of said type-wheel, means for actuating said shifter mechanism and electrically controlled selective stop devices for variably limiting the movement of said type-wheel.

23. In printing telegraphs, a type-wheel yieldingly held in central position, shifter mechanism arranged to rotate said type-wheel, a pair of operating magnets for respectively moving said shifter mechanism and type-wheel in opposite directions, separate sets of selectively controlled stops for variably limiting the movement of said type-wheel and shifter mechanism and a switch in the energizing circuit of each of said magnets and to be shifted by the operation of any one of the corresponding sets of stops.

24. In printing telegraphs, a type-wheel yieldingly held in central position, shifter mechanism arranged to rotate said type-wheel, a pair of operating magnets for respectively moving said shifter mechanism and type-wheel in opposite directions, separate sets of selectively controlled stops for variably limiting the movement of said type-wheel and shifter mechanism, a printing hammer, an energizing circuit therefor and separate switches in said circuit arranged to be respectively actuated by said shifter mechanism when moved in one or the other direction.

25. In printing telegraphs, a type-wheel yieldingly held in central position, shifter mechanism arranged to rotate said type-wheel, a pair of operating magnets for respectively moving said shifter mechanism and type-wheel in opposite directions, separate sets of selectively controlled stops for variably limiting the movement of said type-wheel and shifter mechanism, a pair of normally open spring contacts in the energizing circuit of each of said shifter-actuating magnets arranged to be brought into engagement by any one of the corresponding sets of stops, a printing hammer, an actuating circuit therefor and separate pairs of normally open spring contacts in said circuit, arranged to be respectively brought into engagement by said shifter mechanism when moved in one or the other direction.

26. In printing telegraphs, a type-carrier, a shifter for said type-carrier, an operating magnet for said shifter, stop devices for variably limiting the throw of said shifter and type carrier, a set of operating magnets for said stop devices, a series of conductors leading respectively to said shifter and stop-actuating magnet and electric means selectively controlling the flow of current through said conductors.

27. In printing telegraphs, a type-carrier, a shifter for said type-carrier, an operating magnet for said shifter, stop devices for variably limiting the throw of said shifter and type, a set of operating magnets for said stop devices, a series of conductors leading respectively to said shifter and stop-actuating magnet, electrical means selectively controlling the flow of current through said conductors, and means controlled by said stop-actuating magnets for closing the energizing circuit of said shifter magnet independently of said selecting means.

28. In printing telegraphs, a type-carrier, a shifter for said type-carrier, an operating magnet for said shifter, stop devices for variably limiting the throw of said shifter and type, a set of operating magnets for said stop devices, a printing hammer, an actuating magnet therefor, branch circuits extending respectively through said shifter magnet, stop-actuating magnets and hammer actuating magnet, electric means selectively controlling the flow of current through said separate circuits and means controlled by said shifter magnet for closing the circuit through said hammer actuating magnet independently of said electric selecting means.

29. In printing telegraphs, a type-carrier having a plurality of rows of type, separate shifters arranged respectively to laterally shift and rotate said type-wheel, separate operating magnets for said shifters, separate sets of stops for variably limiting the lateral and rotary movements of said type-wheel, separate sets of actuating magnets, a printing hammer and actuating magnet therefor, a series of branch circuits leading respectively to said shifter, stop-actuating and hammer magnets, electric selective means for closing any one of said circuits, means controlled by each set of stop-magnets for independently closing the energizing circuit of the corresponding shifter magnet and means controlled by one of said shifter magnets for independently closing the energizing circuit of said hammer-actuating magnet.

30. In printing telegraphs, a type-carrier, a pair of spring-held stops arranged to yieldingly hold said type-carrier in central position, shifter mechanism for moving said type-carrier in opposite direction against the resistance of one or the other of said yielding stops, selector mechanism controlling the movement of said shifter and type-carrier, a printing hammer for effecting the impression of the selected type, operating electro magnets for said shifter mechanism, said selector mechanism and said printing hammer and a normally closed switch in the energizing circuit of all of said magnets arranged to be opened by the operation of said hammer-actuating magnet whereby said type-wheel and shifter mechanism are restored to normal, central position by said spring-held stops.

31. In printing telegraphs, a type-carrier, a shifter therefor, stop devices arranged to variably arrest the shift of said type-carrier, a set of circuits arranged to control the operation of said stop devices and also each arranged to effect the operation of said shifter, and electrical means arranged to selectively energize said set of circuits and to effect the independent operation of said shifter.

32. In printing telegraphs, a type-carrier, a shifter therefor, an operating magnet for said shifter, a set of stops for variably arresting the shift of said type-carrier, a set of operating magnets therefor, a series of controlling circuits and stop-actuating magnets, each arranged to effect the operation of said shifter magnet, a separate controlling circuit for said shifter magnet and electrical means selectively controlling the circuits of said shifter and stop-actuating magnets.

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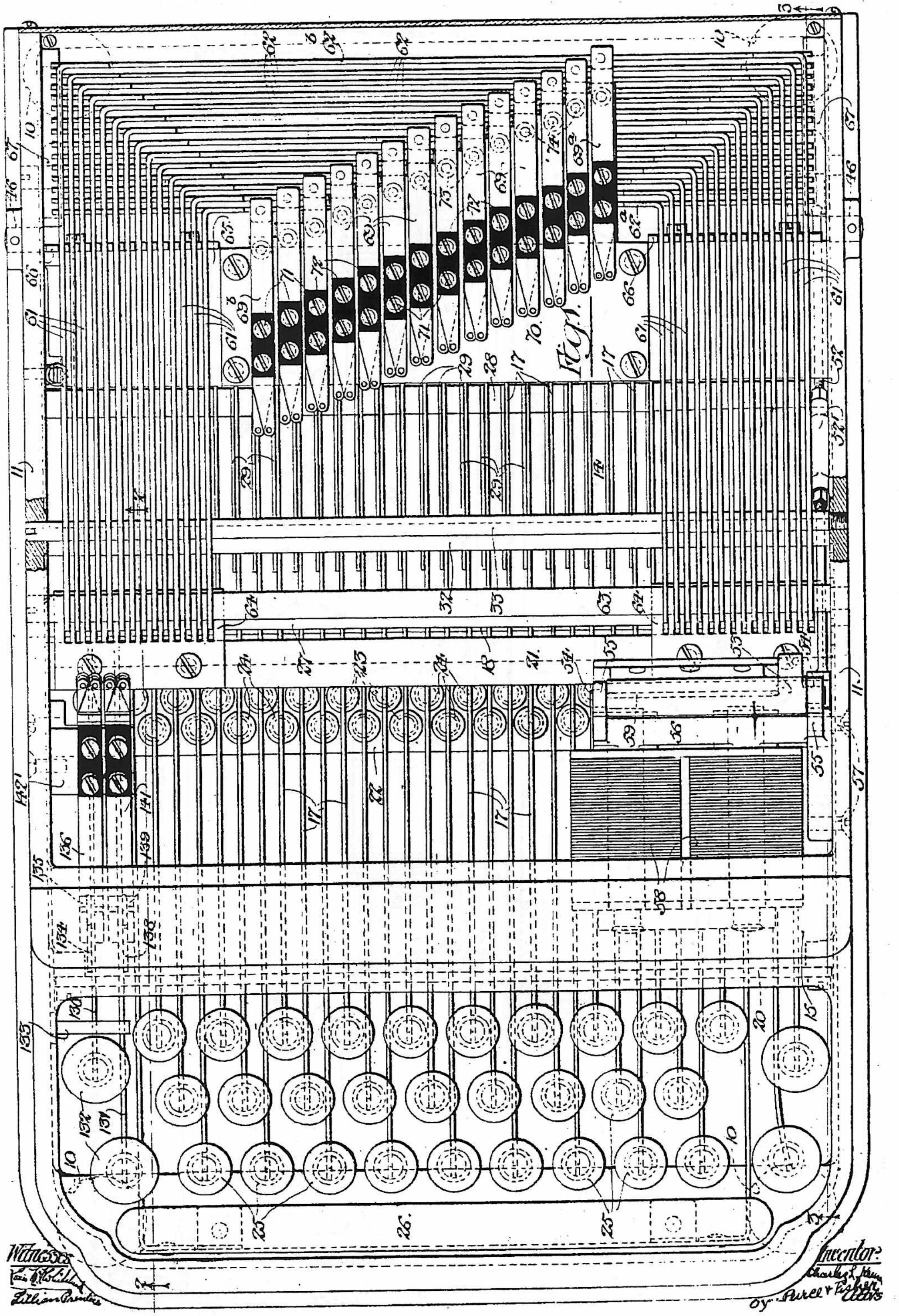
TRANSMITTER FOR AUTOMATIC TELEGRAPHS.

APPLICATION FILED AUG. 31, 1906.

929,603.

Patented July 27, 1909.

6 SHEETS—SHEET 1.



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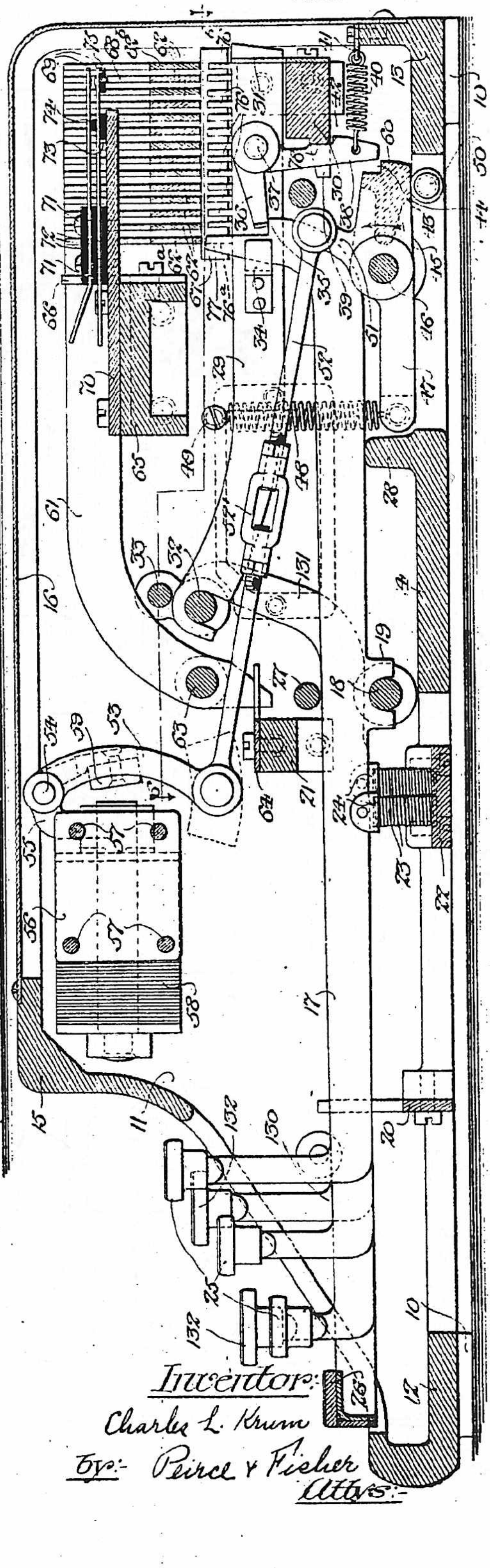
6 SHEETS—SHEET 2.

Fig. 3.



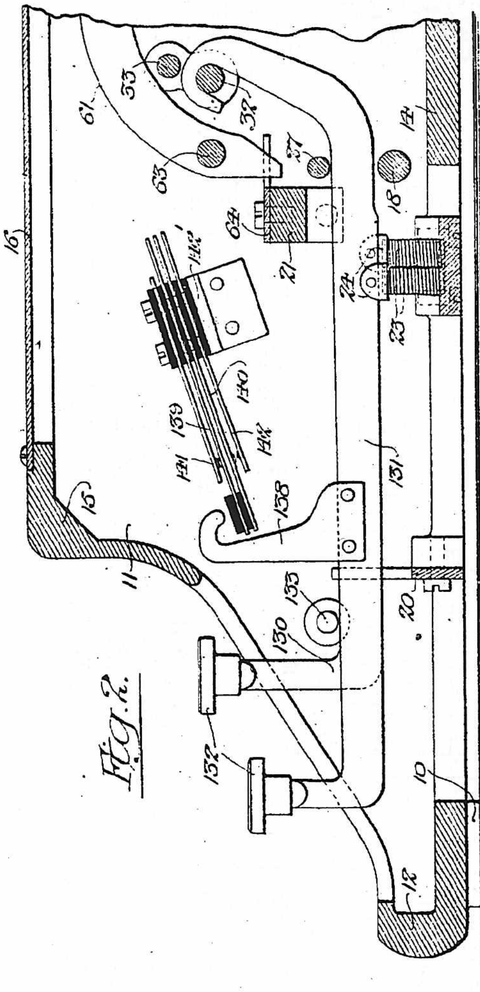


Fig. 2.

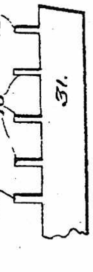


Fig. 4.

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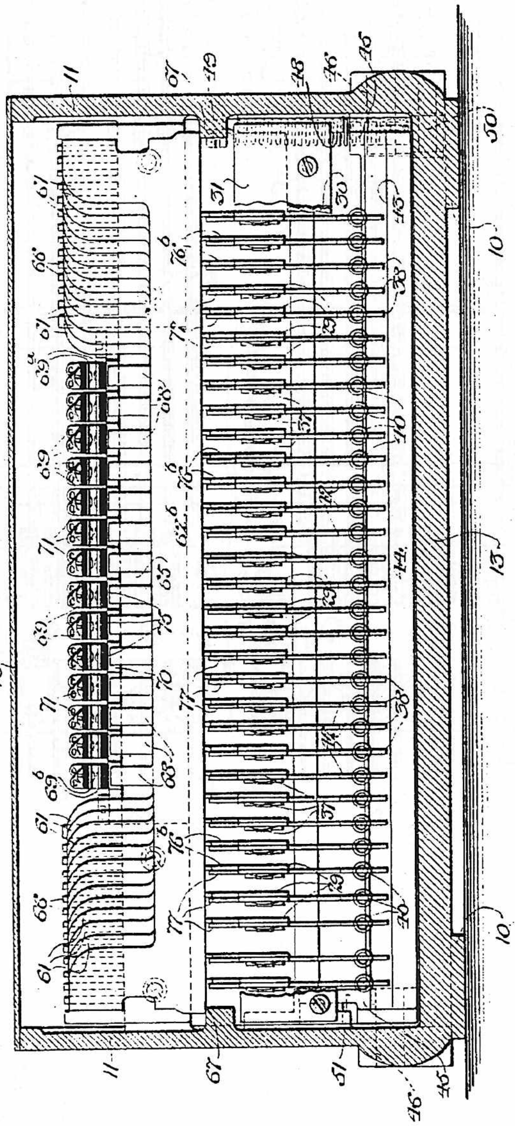
6 SHEETS—SHEET 3.

Fig. 5.



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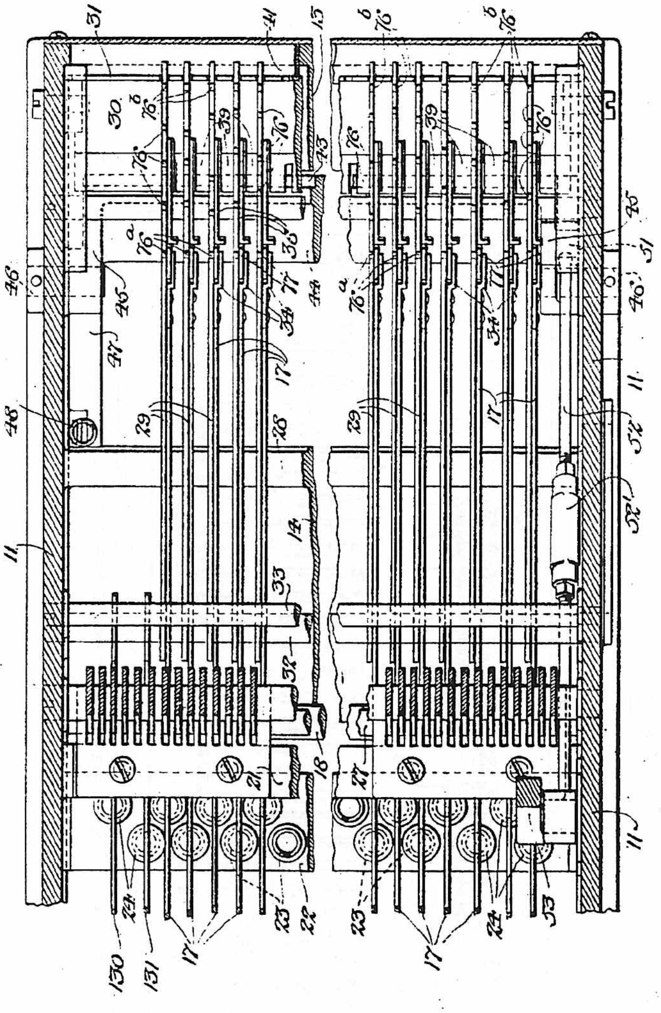
6 SHEETS—SHEET 4.

Fig. 6.



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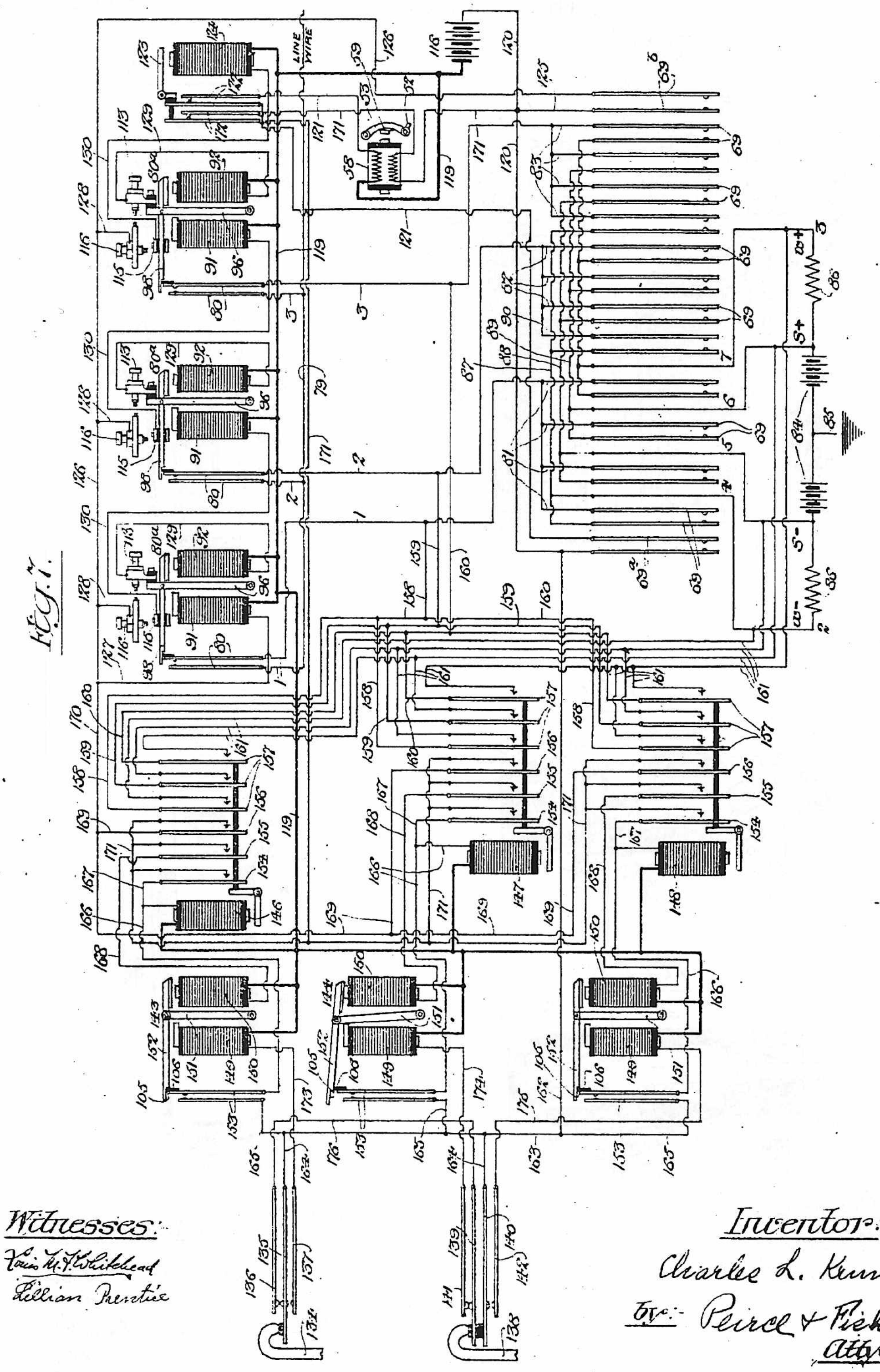
6 SHEETS—SHEET 5.



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6 SHEETS—SHEET 6.

Fig. 8.

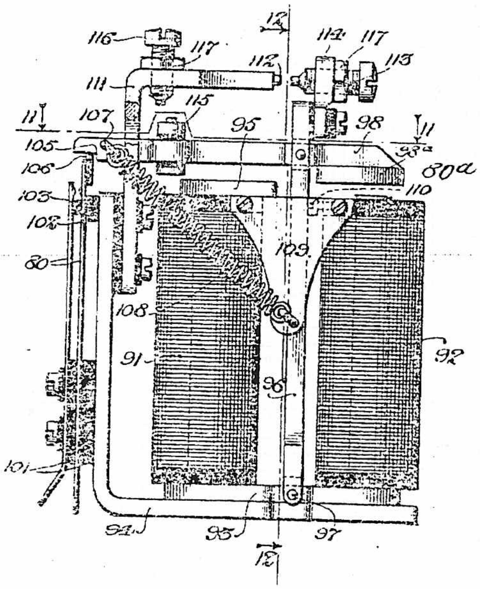


Fig. 9.

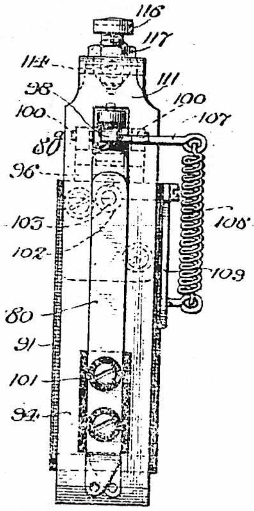


Fig. 10.

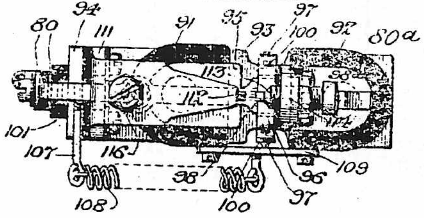


Fig. 11.

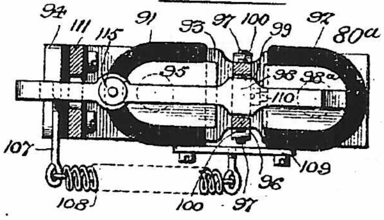
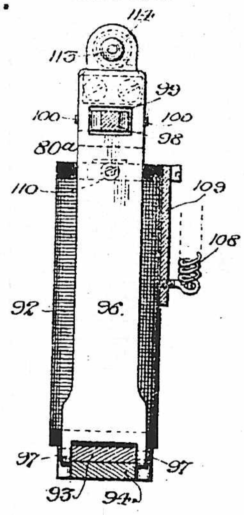


Fig. 12.



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UNITED STATES PATENT OFFICE.

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TRANSMITTER FOR AUTOMATIC TELEGRAPHS.

No. 929,603. Specification of Letters Patent. Patented July 27, 1909.

Application filed August 31, 1906. Serial No. 332,775.

To all whom it may concern:

Be it known that I, CHARLES L. KRUM, a citizen of the United States, and a resident of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Transmitters for Automatic Telegraphs, of which the following is declared to be a full, clear, and exact description.

The invention relates to transmitters for automatic or printing telegraphs and seeks to provide a simple and effective apparatus by which the combinations of code impulses representing the different signals or characters may be rapidly transmitted over the line with distinctness and regularity.

The invention further seeks to provide a construction which shall consist of few operating parts and contacts and which parts are readily accessible for repairs or the like.

Further objects of the invention are to provide means whereby the different combinations of characteristic impulses representing the several characters may be selected by a set of finger keys, together with automatic means for transmitting the selected signal or combination of impulses to the line with precision and regularity, and to provide a key mechanism for selecting the characteristic impulses which shall be of light touch and capable of rapid operation.

The invention also seeks to provide special shift keys which are arranged to transmit one special signal when depressed and another when released so that the shift mechanism at the different receiving station may be moved from normal when the shift key at the transmitter is depressed and restored when the shift key is released in the manner similar to the operation of the shift mechanism of an ordinary typewriter.

With these and other objects in view the invention consists in the features of construction, combinations and arrangements of parts hereinafter set forth, illustrated in the accompanying drawings and more particularly pointed out in the appended claims.

In the figures, Figure 1 is a plan view of the improved transmitter with the inclosing casing removed. Figs. 2 and 3 are longitudinal sections taken on the lines 2—2 and 3—3 respectively of Fig. 1. Fig. 4 is a detail view of one of the so-called "character type". Fig. 5 is a view in rear elevation of the operating mechanism with the frame shown in section. Fig. 6 is a view in horizontal section taken on the line 6—6 of Fig. 3. Fig. 7 is a diagram of the circuits and magnets controlled by the switches and finger keys of the transmitter. Fig. 8 is a view in side elevation of one of the automatic transmitter relays. Fig. 9 is an end elevation thereof. Fig. 10 is a plan view of the transmitter relay. Fig. 11 is a horizontal section on the line 11—11 of Fig. 8. Fig. 12 is a vertical section on the line 12—12 of Fig. 8.

The frame is mounted on feet 10 and comprises side pieces 11 connected at their lower portions by the front bar 12, rear bar 13 and intermediate cross piece 14 and connected at their upper front portions by the cross bar 15. The sides 11 and cross bars 12, 13, 14 and 15 are preferably cast in one piece. The key board is arranged at the open front portion of the frame while the top and back of the frame is provided with a removable cover plate 16 inclosing the operative parts of the transmitter. The keys or key levers 17 are preferably in the form of the thin, flat bars extending from front to rear of the machine and pivotally mounted on a cross fulcrum rod 18. Fulcrum rod 18 extends between the sides 11 of the frame and the keys 17 are provided on their lower edges with lugs 19 having semi-circular notches therein that engage the fulcrum rod. The keys are held on edge in vertical position and are guided by a front comb-bar 20 and a comb-bar 21 above the fulcrum rod 18. These bars extend between and are secured to the side frame pieces 11. A cross bar 22 beneath the key levers is socketed to receive the lower ends of a series of cushion springs 23, the upper ends of which fit into circular cap pieces 24 (see Figs. 1 and 6) which are pivoted to the lower edges of the key levers 17. The forward ends of the key levers are upturned and provided with finger pieces 25 that are arranged in banks or rows, one above the other, at the key board of the machine. Two of the key levers adjacent the sides of the machine are connected by a transverse space bar 26 arranged at the front of the key board. The notched lugs 19 loosely fit upon the fulcrum bar 18 but the key levers are held against displacement by a transverse locking rod 27 which is removably secured in position adjacent the upper edges of the keys and above the fulcrum rod 18.

By removing the locking rod 27 any one or more of the keys may be readily taken out for repairs or the like. The cushion springs 23 are arranged slightly in front of the fulcrum rod 18 and normally uphold the finger pieces at the forward ends of the keys with the rear portions of the keys in engagement with the transverse stop-bar 28 that is connected to or formed in piece with the bar 14.

The keys or key levers 17 are held in position between the fulcrum rod 18 and the locking rod 27 and between the downwardly extending teeth of the comb-bar 21 and the upwardly extending teeth of the comb-bar 20. The cushion springs 23 are arranged adjacent the pivot point and normally uphold the front ends of the keys. The keys may be readily manipulated and the touch is light and elastic.

Above the rear ends of the keys extend a series of type bars 29. These bars are thin and flat and are arranged on edge with their rear portions extending horizontally above a cross bar 30 and through the upwardly projecting teeth of the comb-bar 31 fixed to the cross bar 30. The forward ends of the bars 29 are inclined upwardly and are pivoted upon a transverse fulcrum rod 32, the lower edges of the bars adjacent their forward ends being provided with open notches which loosely set over the fulcrum rod. A transverse locking rod 33 extends over the fulcrum rod 32 above the ends of the bars and holds the latter against displacement. Rod 33 is removable so that any one of the bars 29 may be taken out of the machine for repairs or the like. One end of the locking rod 32 is reduced and threaded into an opening in one side 11 of the frame, while the other end of the rod extends through the opposite side frame and is provided with a cross notch to receive a suitable tool. Rods 18, 27 and 32 are also preferably held in position between the side portions 11 of the frame in a similar manner.

The rear-upturned ends of the several key levers are arranged against the side faces of the series of type bars 29 and are held in such relation by clips 34 (see Figs. 3 and 6) which are riveted or otherwise suitably secured to the sides of the bars 29. The rear end of the key lever is also provided with a ledge or shoulder 35 which engages one arm 36 of a bell crank that is connected by a pivot stud 37 to the adjacent type bar 29. The bell cranks are pivoted to the type bars 29 adjacent their rear ends and the arms 36 extend forwardly from the pivots with their off-set ends engaging the shoulders 35 of the key levers. The downwardly depending arms 38 of the bell cranks extend through a series of forwardly projecting comb-teeth 39 on the cross bar 30 and their lower ends are connected by a series of horizontal springs 40 to a plate 41 on the cross bar 13.

The arms 38 are provided adjacent their lower ends with rearwardly projecting shoulders 42 extending beneath the cross bar 30 so that the type bars 29 and the rear ends of the key levers are locked against accidental shift in vertical direction. When any one of the keys is operated however, it turns the corresponding bell crank about its pivot point 37 and moves its lower end into engagement with a notch or shoulder 43 upon a shifter bar 44. This shifter bar extends across the machine from side to side and is provided with arms 45 at its ends that are pivoted on studs 46 which extend inwardly from the sides of the frame. One of the side arms 45 of the shifter bar is provided with a forwardly extending portion 47 that is connected by a tension spring 48 to a pin 49 on the adjacent side portion 11, so that the shifter bar is normally held depressed into engagement with a stop pin 50 that projects inwardly from the side frame piece 11. The arm 45 of the shifter bar on the opposite side is provided with an upwardly projecting lug 51 that is connected by a link 52 to the lower end of a swinging frame 53. Frame 53 is provided at its upper ends with pivot studs 54 that extend through ears 55 on a frame 56 secured to the adjacent side of the frame by screws 57. Frame 56 carries an electro magnet 58, the armature 59 of which is mounted on the swinging frame 53. Link 52 is preferably adjustable and formed of two sections connected by a turn-buckle 52′ having right and left hand threads.

The circuit of the shifter operating magnet 58 is arranged to be closed by the operation of any one of the finger keys, so that when one of the keys is depressed to lift its rear end and turn the corresponding bell crank 36—38 into the notch 43 of the shifter bar 44, magnet 58 is energized to attract its armature 59 and turn the shifter bar through the medium of the link 52 and thus lift the bell crank 36—38 and the corresponding type bar 29. At the same time the side face 60 of the shifter bar moves up in front of the other arms 38 and positively holds them against the cross bar 30 with their shoulders 42 beneath such bar. In this way any one of the type bars 29 may be operated but all the remaining bars and all the remaining key levers as well are positively locked against movement and cannot be actuated until the shifter or lock-out bar 44 has returned to normal position. It should be noted that the bar 44 acts both as a common shifter for the type bars 29 and also as lock-out for these bars. The bell cranks 36—38 form connections which, under control of the several key levers, serve to connect the selected type bar with the common shifter. They also serve as latches and coöperate with the shifter or lock-out bar to hold all of the key levers and type bars, except the one selected, against movement.

Above the type bar 29 is mounted in horizontal series a number of U-bars which are set one within the other and each comprising side bars 61 and a cross bar 62. The forward downturned ends of the side bars 61 are mounted upon a transverse pivot rod 63 and their extreme ends engage the rearwardly extending teeth of two comb-bars 64 (see Figs. 1 and 3) that are fixed to the cross bar 21. The rear horizontal portions of the side bars 61 rest upon the upper face of a horizontal cross bar 65 and extend through the upwardly projecting teeth of comb-bars 66 that are fixed to the rear face of the cross bar 65. At their extreme rear ends each side bar is bent inwardly and downwardly (see Fig. 5) and connects to the corresponding horizontal cross bar 62. These cross bars are all the same length (see Fig. 1) and rest at their ends upon horizontal ledges 67 on the inner faces of the side portions 11 of the main frame. There are fourteen of these U-bars in the form shown and each horizontal cross bar 62 is provided with an upwardly projecting lug 68 arranged to operate one of a set of fourteen switches 69 mounted upon a supporting plate 70 that is carried upon the horizontal cross bar 65 between the side portions 61 of the U-bars. Each switch comprises two spring contacts secured to the supporting plate 70 by screws 71. Layers of suitable material 72 insulate the two contacts of each switch from each other and from the supporting plate 70 and fastening screws 71. The lower spring of each switch rests upon an insulating button 73 at the outer edge of the supporting plate 70 and each button is provided with a projection 74 extending through the lower spring and engaging the upper spring of the switch so that the separate contacts of each switch are normally held out of contact. The several lugs 68 upon the cross bars 62 are arranged to engage insulating buttons 75 on the rear ends of the lower spring of each switch.

The series of bars 29 are provided at their ends with what may be termed "character type" consisting of a series of projecting lugs extending upwardly from their upper edges and which are arranged to engage and shift the switch operating cross bars 62. Each of the bars 29 is provided with a lug 76^a which is arranged to engage the cross bar 62^a and close the switch 69^a, and this switch is arranged to close the circuit of the shifter operating magnet 58. Each type is also provided with a lug 76^b which is arranged to operate the last cross bar 62^b of the set, which in turn closes the switch 69^b. Each of the type is also provided in the form shown, with three lugs 76 that are variably arranged on the several type so that each type will operate a different or characteristic combination of the set of bars 62 and thus, each of the type closes a different and characteristic combination of the set of switches 69. That is to say, all of the character type will close the switch 69^a which controls the shifter operating magnet and all of the type will close the switch 69^b which controls the operation of the automatic transmitters hereinafter described. Of the sets of twelve switches 69 each is arranged to be operated by a number of different type, but each type actuates a distinct and characteristic combination of three switches 69 in the set of twelve, and these combinations correspond to or represent the several characters or signals.

The rear upturned end of each of the key levers is also provided with a projection 77 arranged to engage the cross bar 62^a and close the switch 69^a of the shifter operating magnet 58. When any key is operated it will turn the corresponding latch 36—38 into the notch 43 of the common shifter bar 44, close switch 69^a to energize the magnet 58 so that the shifter bar 44 is lifted by the magnet to complete the upward movement of the selected character type and close the combination of switches corresponding to the key depressed. The finger keys are thus relieved of the actual work of closing the several switches and the touch is correspondingly lighter so that the keys may be operated easily and rapidly. Moreover, the arrangement insures that the proper set of switches will be closed and held closed, even though the key be only slightly depressed, since as soon as the circuit of the shifter operating magnet 58 is closed the selected character type is held in lifted position until the circuit through the magnet is broken, although the key itself is free to return to normal position. The key itself may be used when depressed to its full extent to lift the corresponding character type since, after it has shifted the latch 36—38 into engagement with the notch 43 of the shifter bar, the continued upward movement of the rear end of the key will elevate the corresponding type although it is assisted and entirely relieved from pressure by the shifter which is actuated by the magnet 58. The selected type will be properly operated even though the key be only slightly depressed, since a slight depression of the key will lift the shoulder 42 on the corresponding latch 38 past the front face 78 of the cross bar 36 so that the latch is locked in its shifted position and its upward movement is completed by the operation of the shifter 44 which in turn is actuated by the magnet 58. The operation of the shifter 44 of course, as previously described, locks all the remaining latches in their normal positions and these in turn prevent the operation of any of the other type or any of the other keys until the magnet 58 is deënergized and shifter bar 44 returned to its normal position.

The arrangement of circuits is shown in the diagram in Fig. 7. The line wire or conductor 79 is provided with three branches 1, 2 and 3 and in each branch is interposed a normally open transmitter switch 80. These transmitter switches are arranged to be closed in succession by a set of relays 80^a, as hereinafter described, so that the line branches are successively connected and disconnected in order from the line conductor 79. The selecting switches 69 are arranged in three sets with four switches in each set. Line branch 1 is connected by the branch conductors 81 to one of the contacts of each switch in the first set. Line branch 2 is connected by a series of branches 82 to one of the contacts of each switch in the second set and line branch 3 is connected by the set of branch conductors 83 to one of the contacts of each switch in the third set.

The line battery 84 is divided and is connected to ground or to the return wire from the distant station by a conductor 85. The battery branches 4 and 5 are connected to one side of the battery and the battery branches 6 and 7 are connected to the other side. Suitable resistance coils 86 are interposed in the battery branches 4 and 7 and it is obvious with the arrangement shown, that when properly connected to the line a weak negative impulse will be transmitted through battery branch 4, a strong negative through battery branch 5, a strong positive through battery branch 6 and a weak positive through battery branch 7. As stated, the switches 69 are divided into three sets of four each and one contact of each switch is connected to one of the set of line branches 1, 2 and 3. The set of battery branches 4, 5, 6 and 7 are connected to the other contact of each switch. Branch conductor 4 is connected by a conductor 87 to the contact of one of the switches in each of the three different sets. Battery branches 5, 6 and 7 are similarly connected by the conductors 88, 89 and 90. With this arrangement it is obvious that any one of the battery branches may be connected to the line branch 1 and to the line branches 2 and 3, and that by selecting any particular combination of three of the set of switches 69 any desired combination of battery branches may be connected to the three line branches 1, 2 and 3. As stated, each of the character type is arranged to select a particular combination of the set of switches 69 so that the proper combination of battery branches is connected to the line branches 1, 2 and 3, then by operating the transmitter switches in order the characteristic signal or combination of impulses will be transmitted to the line 79 and back by the return conductor 85 to the battery 84.

The transmitter switches 80 are automatically controlled by a set of relays 80^a, each of which preferably comprises two magnets 91 and 92 (see Figs. 8 to 12 inclusive). At their lower ends magnets 91 and 92 are provided with a common pole piece 93 of soft iron and they are mounted upon an L-shaped piece 94 of brass or other non-magnetic material. At its upper end the magnet 91 is provided with an inwardly extending pole piece 95 and the armature of the magnet 91 is in the form of a bar 96 vertically arranged between the two magnets and having a forked lower end which sets over and is connected by pivot studs 97 to the pole piece 93. The armature lever 98 carrying armature 98^a of the second magnet 92 of the relay extends through an opening 99 (see Fig. 12) in the armature lever 96 and is connected thereto by pivot pins or studs 100. Parts 96 and 98^a are of soft iron to complete the magnetic circuit of the two magnets.

The two spring contacts of the switch 80 are carried on an insulating mount 101 in the upright portion of the piece 94. The innermost spring rests against an insulating button 102 on the upper end of the piece 94 and this button has a projection 103 that extends through the innermost spring contact and engages the outer spring contact to normally hold the two apart. The end of the inner spring contact is provided with a piece of insulating material 106 and the end of the armature lever 98 is provided with a notch or shoulder 105 that normally engages this insulating piece. A projecting pin 107 on the end of the armature lever 98 is connected by a spring 108 to the lower end of a brass plate 109 that is secured at its upper ends to the spools of the magnets 91 and 92. This spring acts both to hold the armature 98 of the magnet 92 against the insulating piece 106 and the armature 96 of the magnet 91 against the stop screw 110 fixed to the upper end of the spool of magnet 92.

A bent piece 111 of brass is secured to the upper end of the piece 94 but is insulated therefrom as shown. The end of the conducting piece 111 is provided with a contact 112 which is arranged to be engaged by a contact screw 113 that is adjustably mounted in a socket 114 which, in turn, is carried upon the upper end of the armature lever 96, but is insulated therefrom as shown. A contact piece 115 on the end of the armature lever 98 is arranged to coöperate with an adjustable contact screw 116 mounted on the bent conducting piece 111. Contact screws 113 and 116 are provided with lock nuts 117.

The magnet 91 is first energized and swings the armatures 96 and 98 to the left about the pivot 97 so that the shouldered part 105 of the armature 98 shifts the contacts of the switch 80 into engagement. At the same time contact 113 is brought into engagement with contact 112 to close the circuit of magnet 92. The right hand end of armature lever 98 is then swung down and its left hand end raised out of engagement with the insulating piece 106 to permit the return of the contacts 80 to open position. At the same time contact 115 is brought into engagement with contact screw 116 to close the circuit of the first magnet in the next succeeding relay. The two magnets of the relay thus operate with accuracy to close and open the transmitter switch 80. The first magnet 91 of the relay closes the contacts, holds them closed for a short interval until the magnet 92 is energized and the switch is then opened. It is not necessary to open the circuit and deënergize either magnet in order to open the switch, and there is no lagging or uncertainty in the operation of the transmitter switches. As soon as the magnets 91 and 92 are deënergized in the manner hereinafter set forth, the spring 108 will return both of the levers 96 and 98 to the normal position shown in the drawings with the shouldered part 105 of the armature lever 98 in engagement with the insulating piece 106 on the inner contact switch 80.

As indicated in the diagram in Fig. 7, the magnets 91 and 92 of the transmitter relays and the shifter operating or locking magnet 58 are all connected to a local battery 118 by a common return conductor 119 indicated in the drawings by heavy lines. The other pole of the battery is connected by a conductor 120 to one of the contacts of the switch 69^a. The other contact of this switch is connected by a conductor 121 to one of the coils of the locking or shifter operating magnet 58, so that this magnet is energized and the shifter bar 44 operated when any key is depressed since all of the keys are arranged to close the switch contacts 69^a. An unlocking switch comprising a pair of normally closed contacts 122 is interposed in the conductor 121 and this switch is arranged to be opened by the armature 123 of an unlocking magnet 124, which in turn, is controlled by the operation of the third line relay 80^a.

One contact of the switch 69^b is connected to the local battery 118 by conductors 120 and 125. The other contact of this switch is connected by wires 126 and branch wire 127 to the coil of the magnet 91 of the first transmitter relay. The conductor 126 is also connected by branch conductors 128 to the contacts 116 of each relay. The contacts 113 of each relay is connected by a conductor 129 to the coil of the second magnet 92 of the same relay and the contact 115 of the first and second relays is connected by a conductor 130 to the coil of the first magnet 91 of the next succeeding relay. The conductor 130 from the contact 115 of the last relay extends to the coil of the unlocking magnet 124.

When any key is operated, the corresponding character type will close the spring contacts 69^a and 69^b and a particular combination of three of the set of switches 69. If for example, it is assumed that the signal to be transmitted comprises a strong positive impulse followed in succession by weak negative and weak positive impulses, the third, eighth and ninth switches 69 of the set are closed to connect the battery branches 6, 7 and 4 to the line branches 1, 2 and 3 respectively. The circuit may be traced through switch 69^a from battery 118 by conductor 120 through the contact 69^a, conductor 121 through the normally closed switch contacts 122 and through the coil of the shifter operating magnet 58 to the battery return wire 119, so that the shifter bar 44 is operated to move the selected character type, hold it in shifted position and momentarily prevent the operation of the other type and their controlling keys. The circuit from battery 118 is also traced by wires 120 and 125 through the contact 69^b to conductor 126 and 127 to the first magnet 91 of the first relay 80^a to the battery return wire 119. This magnet is energized to shift the armatures 96 and 98 of the first relay, close the transmitter switch 80 in the line branch 1 and thus connect it to line. Contacts 113 and 116 of the first relay are engaged and the circuit closed through the second magnet 92 of the first relay from the battery wire 126, branch conductor 128, contacts 116 and 113 and conductor 129 through the coil of the second magnet 92 of the first relay to the battery return wire 119. The armature lever 98 of the first relay is then shifted to disconnect the line branch 1 from the line conductor 79. Contacts 115 and 116 of the first relay are brought into engagement to close the circuit from battery wire 126, conductor 128, contacts 116 and 115 and conductor 130 through the coil of the first magnet 91 of the second relay to the battery return wire 119. The magnet 91 of the second relay in turn closes the transmitter switch 80 in the line branch 2 and in a similar manner closes the circuit of the second magnet 92 of the second relay so that the switch 80 of the second line branch is opened after a brief interval. The magnets 91 and 92 of the third relay then operate in succession to close and open switch 80 in the third line branch 3. The several magnets 91 and 92 of the line relays thus act in order to successively connect and disconnect line branches 1, 2 and 3 to the line conductor 79. When the line branch 1 is connected to line, current may be traced from the line battery 84 by a battery branch 6, conductor 89 to the closed contacts of the third switch 69, branch conductor 81, line branch 1 through the closed contacts 80 in the first line branch to the line wire 79 and thence to the distant station and back by ground or by a suitable return wire to the battery 84. While the line branch 2 is connected to line current is traced from line battery 84, branch 7, conductor 90 to the closed contacts of the eighth switch 69, conductor 82 to line branch 2 through the closed switch contacts 80 therein to the line 79 and back as before to battery. When the switch of the third branch is closed current is traced from battery 84 by branch 4 and conductor 87 to the closed contacts of the ninth switch 69, conductor 83 to the line branch 3 through the closed contacts thereof to the line wire 79 and back by the return wire or ground to the line battery 84. In this way the selected battery branches 6, 7 and 4 are successively connected in order to the line wire to transmit a strong positive impulse followed by weak positive and weak negative impulses. It is obvious that any of the battery branches may be connected to any of the line branches so that by properly selecting the combination of three in the set of switches 69, any desired combination of three impulses, either strong or weak or positive or negative, may be transmitted over the line conductor.

The operation of the second magnet 92 of the last relay closes the circuit through the unlocking magnet 124 so that the contacts 122 are opened and the circuit broken through the magnet 58 to permit the return of the shifter bar and selected character type to normal. The switches 69^a and 69^b and selected combination of switches 69 are then restored to their normal open condition and circuit through the transmitter relays 81 controlled by the switch 69^b is open so that all parts operated thereby are returned to normal in readiness to transmit the next succeeding signal. The connections between the battery branches 4, 5, 6 and 7 and the line branches 1, 2 and 3 controlled by the set of switches 69, is also restored to the normal open condition indicated in the drawings.

It should be noted that the speed of transmission of any one combination of impulses is in no way controlled by the action of the finger keys. Each finger key simultaneously operates a given combination of the selecting switches 69 to connect the proper combination of battery branches to the line branches. At the same time the key initiates the operation of the transmitter relays 80^a which act automatically to successively connect and disconnect the line branches and the line conductors 79. The various impulses of any signal are thus transmitted with great precision and regularity, such as is necessary for the rapid operation of any printing apparatus at the receiving station.

The work of closing the selecting switches and transmitter switches is done by the magnet 58 and relay magnets 91 and 92, and the finger keys merely control the proper selection of the different signals so that the touch is very light and the keys may be rapidly operated. The lock-out bar positively prevents the movement of any key or character type during the operation of the transmitter relays 80^a, so that two signals cannot be superposed one upon the other or otherwise confused.

As stated, the switch 69^a operated by the cross bar 62^a and the projections 76^a on the character type controls the circuit of the shifting and lock-out magnet 58, the switches 69 operated by the cross bars 62 and the projections 76 of the character type, which are differently arranged upon the different type bars to control the selection of the combination of impulses to be transmitted, and the switch 69^b operated by the cross bar 62^b and the projections 76^b on the several character type controls the circuit to the first transmitter relay. As shown in Figs. 3 and 4, the projection 76^a is slightly greater in length than the projections 76 and the projections 76 are slightly greater in length than the projection 76^b, so that the circuit of the locking magnet 58 is closed an instant before the connections are made between the battery branches 4, 5, 6 and 7 and the line branches 1, 2 and 3 and the connections between the line and battery branches is made an instant before the operation of the transmitter relays is initiated. The proper transmission of the selected signal is thus insured.

It should also be noted that the fulcrum rods 32 and 63 of the type bars 29 and switch operating U-bars respectively are in the same horizontal plane with the lower edges of the cross bars 62, so that the projections 76, 76^a and 76^b on the character type will squarely and properly engage the cross bar 62 to firmly press the switch contacts controlled thereby into engagement.

The transmitter is provided with two shift keys which are operated in a manner similar to the keys of an ordinary typewriter. That is to say, when the key is depressed a special signal is transmitted over the line for effecting the shift of the platen or type wheel at the receiving station so that capitals or numerals may be printed as long as one or the other of the shift keys is held depressed. When the key is released another special signal is transmitted to unlock the shift mechanism and permit its return to normal so that thereafter the most frequently used characters or small letters will be recorded at the receiving station.

The shift keys 130 and 131 are arranged at the left hand side of the key board and their upturned forward ends are provided with finger pieces 132. The shift keys are not pivoted on the fulcrum rod 18 but extend between this rod and the locking rod 27 (see Fig. 2) and their rear ends are upturned and provided with hook shaped bearing portions engaging the fulcrum rod 32. The lower edges of the shift key above the fulcrum rod 18 are cut away as shown, so that the rod will not interfere with the proper swing of the shift keys about the pivot rod 32. A stop pin 133 projects inwardly from the side 11 of the frame and extends over the shift keys. The latter are provided with cushion springs 23 similar to those employed in connection with the other keys which normally uphold the shift keys against the stop pin 133. Like the rest of the keys the shift keys 130 and 131 extend through the teeth of the comb-bars 20 and 21.

Shift key 130 is provided with an upwardly projecting lug 134 (see Fig. 7) which is arranged to engage an insulated button on a switch contact spring 135. This switch contact is normally in engagement with the spring contact 136 and when depressed by the key it is moved out of engagement with the contact 136 into engagement with the spring contact 137 below it and from which it is normally disengaged.

The shift key 131 (see Figs. 2 and 7) is provided with a similar hook 138 which is arranged to shift two switch contacts 139 and 140. Contact 139 is normally in engagement with a contact 141 but is shifted out of engagement therewith by the operation of the key. Contact 140 is normally out of engagement with the spring contact 142 but is shifted into engagement therewith by the operation of the shift key. The switch contacts 135, 136 and 137 and the switch contacts 139, 140, 141 and 142 are mounted above the shift keys upon an inwardly projecting lug or support 142′ fixed to the side 11 of the frame. These contacts are suitably insulated from each other and from the support, as indicated in Fig. 2.

The circuits extending from the switch contacts are operated by the shift keys, as indicated in the diagram in Fig. 7. The two sets of switch contacts are arranged to control the operation of three relays 143, 144 and 145 and these relays control respectively the operation of a set of magnets 146, 147 and 148. Each of the relays comprises two magnets 149 and 150 and the armatures 151 and 152 of these magnets are arranged in a manner similar to the armatures of the transmitter relay magnets 91 and 92. That is to say, the armature 152 of the magnet 150 is pivotally mounted on the end of pivoted armature 151 of the magnet 149, so that by successively closing the circuits of the magnets of each relay, a switch 153 is first closed and then opened by the compound movement of the armature lever 152, the notched end of which is arranged to engage an insulating piece on the end of one of the switch contacts 153.

The armature of each of the magnets 146, 147 and 148 is arranged to operate the switches 154, 155, 156 and a set of three switches 157. The first switch 157 in each set is connected by branch conductors 158 to the first line branch 1 and the second and third switches 157 in each set are connected by the branch conductors 159 and 160 to the line branches 2 and 3 respectively. The contacts of the sets of switches 157 are connected by a series of conductors 161 to the different battery branches 4, 5, 6 and 7 so that by operating any one of the set of switches 157, a particular combination of three of the battery branches may be connected respectively to the line branches 1, 2 and 3. For example, in the arrangement shown the set of switches 157 operated by the magnet 146 are adapted to connect the battery branches 4, 5 and 6 to the line branches 1, 2 and 3 respectively. The switches 157 operated by the magnet 147 are adapted to connect the set of battery branches 5, 6 and 7 to the set of line branches 1, 2 and 3 respectively, and the set of switches 157 operated by magnet 148 are adapted to connect the battery branch 7 to the line branches 1 and 3 and the battery branch 5 to line branch 2. Any other combinations of battery branches could of course be employed, provided they did not conflict with the other signals, it being merely necessary that the combination selected by the switches of magnet 146 and 147 shall be of proper kind to operate the shifter mechanism of the receiver to different positions and that the combination selected by the switches 157 operated by the magnet 147 shall be of proper kind to operate the shifter release at the receiving station.

The local battery 118 is connected by the conductors 120, 162, 163, 164 and 165 to the switch contacts 135 and 140, that are operated by the lugs 134 and 138 on the shift keys, and to one of the contacts of each switch 153. The other contacts of the several switches 153 are connected by conductors 166 to the coils of the several magnets 146, 147 and 148 respectively, and the coils of these magnets are also connected by conductors 167 to the switches 154 operated by the magnets. The switches 155 operated by these magnets are connected by conductors 168 to the coils of the magnets 150 in the respective relays 143, 144 and 145. The switches 156 are connected by the conductors 169 and 170 to the conductor 127 leading to the first magnet 91 of the first transmitter relay 81. The contacts of the several switches 154, 155, and 156 are connected by the branch conductor 171 to the local battery 118. This conductor 171 leading from the battery extends through a coil in the locking magnet 58 and through a normally closed unlocking switch 172 which is opened by the armature 123 of the unlocking magnet 124.

The coil of the magnet 149 of the relay 143 is connected by a conductor 173 to the switch contact 137. Magnet 149 of relay 144 is connected by a conductor 174 to the switch contact 141 and the magnet 149 of the relay 145 is connected by a conductor 175 to the contact 142. Switch contacts 136 and 139 are connected together by a conductor 176. The coils of the relay magnets 149 and 150 and of the magnets 146, 147 and 148 are all connected to the common return wire 119 leading back to local battery 118.

As stated, the contacts 139 and 141 and the switch contacts 135 and 136 are normally in engagement so that the circuit is normally closed through the first magnet 149 of the relay 144 as follows: from local battery 118 by conductors 120, 162, 163, 164, switch contacts 135 and 136, conductor 176, switch contacts 139 and 141, conductor 174 through the coil 149 of the relay 144 and back by the common return wire 119 to battery. The armature lever 151 of this relay is thus drawn up as shown, but the switch contacts 153 controlled thereby are not closed since the magnet 150 of this relay has been previously operated to shift the armature lever 152 thereof and thus open the contacts 153, the armature lever resting, as indicated, upon the insulating piece 106 on the end of the inner spring contact but with its shoulder or notch 105 out of engagement therewith. The operation of either shift key however, will open either the pair of contacts 136 and 135 or the pair of contacts 141 and 139 to open the circuit of the magnet 149 of the relay 144 and thus permit the armatures 151 and 152 to drop back into normal position with the notched shoulder 105 of the armature lever 152 in position to first close and then open the contacts 153 of this relay. The depression of the shift key 130 through the medium of the hooked projection, 134, as stated, opens the circuit through the magnet 149 of the relay 144 so that the armatures 151 and 152 thereof are restored to normal by their spring and at the same time contacts 135 and 137 are brought into engagement to close the circuit from local battery 18 through the conductors 120, 162, 163 and 164, contacts 135 and 137, conductors 173 through the coil of the magnet 149 of the relay 143 and back to the battery return wire 119. The switch contacts 153 are then closed and the circuit is traced from the battery conductors 120, 162, 163 and 165 through the closed contacts 153 of the relay 143 through the coil of the magnet 146 and back by the battery return wire 119. The several switches controlled by the magnet 146 are then shifted to closed condition and the combination of battery branches 4, 5 and 6 are connected to the line branches 1, 2 and 3. The switch 154 of the magnet 146 closes the circuit from the local battery 118 by the conductors 120 and 171 through the coil of the locking magnet 58, normally-closed locking switch 172, switch 154 and conductor 167 through the coil of the magent 146 to the battery return wire 119. The circuit through magnet 146 is left locked in closed condition. The switch 155 closes the local battery circuit from the wire 171 through the switch 155 and by conductor 168 through the coil of the second magnet 150 of the relay 143 to the battery return wire 119, and armature lever 152 is operated to open the contacts 153. Switch 156 closes the circuit from the battery wire 171 through the conductors 169, 170 and 127 to the magnet 91 to the first line relay so that the operation of the set of line relays is initiated to automatically and successively connect the several line branches 1, 2 and 3 to the line conductor and the special combination or shifting signal is transmitted. At the end of the transmission of the special spacing signal, unlocking magnet 124 is energized to open locking switch 172 and all parts of the transmitting mechanism except the shift key and relay 143 and 144 are restored to normal. At the receiving station the shifter mechanism is moved by the special signal and is held locked in its shifted position so that by holding the shift key 131 depressed, the other keys may be operated to print capitals, figures or other infrequently used characters, as desired.

When the shift key is restored to normal, the engagement of contacts 135 and 137 is broken and magnet 149 of the relay 143 deenergized so that the armatures 151 and 153 of this relay are returned to normal position at the same time contact 135 is again brought into engagement with contact 136 and the circuit is closed through the first magnet 149 of relay 144. The armatures of this relay are then drawn up to close the switch contacts 153 thereof and the circuit is closed through the magnets 147 as follows: from battery conductors 120, 162, 163, 165, switch contacts 153 and relay 144, conductor 166 through the coil of magnet 147 to the battery return wire 119. The set of switches controlled by the magnet 147 are then operated to send another special signal over the line in a manner entirely similar to that of the magnet 146, as above described. The circuit through the second magnet 150 of the relay 144 is closed by the operation of magnet 147 and opened by the operation of the unlocking magnet 124, but the circuit of the magnet 149 of the relay 144 remains normally closed so that, as stated, the armature levers 151 and 152 are normally drawn up as indicated.

When the shift key 131 is depressed its hooked projection 138 opens the contacts 139 and 141 so that the magnet 149 of the relay 144 is deënergized and its armature levers dropped back. At the same time contacts 140 and 142 are brought into engagement and the circuit is closed from the battery by the conductors 120, 162, 164, contacts 140, 142 and 175 through the coil of magnet 149 of the relay 145. This relay then operates to close its switch contacts 153 and energized magnet 148 to transmit another special shifting signal over the line. When the shift key 131 is released, contacts 139 and 141 are again brought into engagement and relay 144 operates to automatically transmit the releasing signal.

During the transmission of either special shifting signal or the releasing signal the locking magnet 58 is energized so that none of the other keys can be operated. Shift mechanism at the receiving station, such as is set forth in the companion application filed by me, is adapted for use in connection with the special arrangement of shift keys herein set forth.

It should be noted that the switches of the transmitter, as indicated in Figs. 3 and 5, are located at the top of the machine above the operating parts where they are readily accessible for inspection or repairs by removing the cover plate 16. The operating parts are also easily accessible and readily removable and cannot easily get out of order. The keys may be operated by a light touch and it is possible to transmit the signals rapidly without confusion by reason of the automatic transmitter relays and the lock-out device controlled thereby.

It is obvious that numerous changes may be made in the details of construction and arrangement of circuits without departure from the essentials of the invention.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In automatic transmitters, the combination of a series of switches, a series of key-controlled character type for operating said switches, each switch being actuated by a number of type, but each type being arranged to simultaneously operate a particular combination of switches and a series of finger keys controlling the operation of said type, and means acting, when one type is operated, to lock the selected combination of switches in shifted position and to lock out the other type, substantially as described.

2. In automatic transmitters, the combination of a series of switches, a series of key-controlled character type for operating said switches, each switch being actuated by a number of type, but each type being arranged to simultaneously operate a particular combination of switches and a series of finger keys controlling the operation of said type, and means for holding the selected type in shifted position independently of its key until the signal transmitted thereby is completed, substantially as described.

3. In automatic transmitters, the combination of a series of switches, a series of key-controlled character type for operating said switches, each switch being actuated by a number of type, but each type being arranged to simultaneously operate a particular combination of switches and a series of finger keys controlling the operation of said type, and means for locking the selected type in shifted position until the signal selected thereby is transmitted and for locking out the other of said type, substantially as described.

4. In automatic transmitters, the combination with a series of switches, of a series of switch shifting bars, one for each of said switches, a series of character type having variably arranged projections and each arranged to operate a particular combination of switch shifting bars, a series of operating keys, one for each of said type, and means controlled by each key for holding the selected type in shifted position and for locking out the other of said type until the completion of the signal transmitted by the selected type, substantially as described.

5. In automatic transmitters, the combination with a series of switches, of a series of switch shifting bars, one for each of said switches, a series of character type having variably arranged projections and each arranged to operate a particular combination of switch shifting bars, a series of operating keys, one for each of said type, and means controlled by each of said keys for holding the selected type in shifted position and for preventing the operation of the other type and their controlling keys until the completion of the signal transmitted by the selected type, substantially as described.

6. In automatic transmitters, the combination with a series of switches, of a series of switch shifting bars, one for each of said switches, a series of character type having variably arranged projections and each arranged to operate a particular combination of switch shifting bars, a series of operating keys, one for each of said type, a series of latches, one for each of said type, and means controlled by said keys and coöperating with said latches to hold the selected type in shifted position and lock out the other type and their controlling keys until the completion of the signal transmitted by the selected type, substantially as described.

7. In automatic transmitters, the combination with the series of switches, of a series of character type for operating said switches, each of said switches being operated by a number of type and each type operating a particular combination of switches, a series of keys controlling the operation of said type, latches on said type with which said keys engage and a common shifter controlled by said keys and coöperating with said latches to hold the selected type in shifted position and prevent the operation of other type and keys until the completion of the signal transmitted by the selected type, substantially as described.

8. In automatic transmitters, the combination with the series of switches, of a series of character type for operating said switches, each of said switches being operated by a number of type and each type operating a particular combination of switches, a series of key levers controlling the operation of said type, a series of pivoted spring-held latches, one mounted on each of said type, said keys engaging said latches and a common shifter engaging said latches to hold the selected type in shifted position and prevent the operation of the other type and keys, substantially as described.

9. In automatic transmitters, the combination with the series of switches, of a series of character type for operating said switches, each of said switches being operated by a number of type and each type operating a particular combination of switches and a series of key levers controlling the operation of said type, a series of latches with which said levers engage, one of said latches being mounted on each of said type, a common shifter coöperating with said latches to hold the selected type in shifted position and prevent the operation of the other of said type and an operating magnet for said shifter, the circuit whereof is closed by the operation of any one of said keys, substantially as described.

10. In automatic transmitters, the combination with a suitable frame, of a set of switch contacts mounted at the upper portion of said frame, a set of pivoted U-bars, one for operating each of said switches, the operating portions whereof extend beneath said set of switches, a series of upwardly-striking pivoted type bars extending beneath said set of U-bars and having variably arranged projections to operate different combinations of bars and a series of pivoted key levers controlling the operation of said pivoted type bars, substantially as described.

11. In automatic transmitters, the combination with a suitable frame, of a set of switch contacts mounted at the upper portion of said frame, a set of pivoted U-bars, one for operating each of said switches, the operating portions whereof extend beneath said set of switches, a series of pivoted type bars extending beneath said set of U-bars and having variably arranged projections to operate different combinations of bars, a series of pivoted key levers for controlling the operation of said type bars and means coöperating with said key levers and type bars for holding the selected type bar in shifted position and for preventing the operation of the other type bars and key levers, substantially as described.

12. In automatic transmitters, the combination with a suitable frame, of a set of switch contacts mounted at the upper portion of said frame, a set of pivoted U-bars, one for operating each of said switches, the operating portions whereof extend beneath said set of switches, a series of pivoted type bars extending beneath said set of U-bars and having variably arranged projections to operate different combinations of bars, a series of pivoted key levers, a series of spring-held latches, one on each of said type bars with which said key levers engage and a common shifter coöperating with said latches to hold the selected type in shifted position and prevent the operation of the other type bars and key levers, substantially as described.

13. In automatic transmitters, the combination with a suitable frame, of a set of switch contacts mounted at the upper portion of said frame, a set of pivoted U-bars, one for operating each of said switches, the operating portions whereof extend beneath said set of switches, a series of pivoted type bars extending beneath said set of U-bars and having variably arranged projections to operate different combinations of bars, a series of pivoted key levers, a series of spring-held latches pivoted on said type bars with which latches said key levers engage, a common shifter coöperating with said latches to hold the selected type bar in shifted position and prevent the operation of the other key levers and type bars and an operating magnet for said shifter, the circuit whereof is controlled by said key levers and type bars, substantially as described.

14. In automatic transmitters, the combination with a set of switches and a set of battery circuits or branches controlled thereby, of a series of character type, each switch being operated by a number of said type and each type being arranged to select a particular combination of switches and battery circuits or branches, automatic transmitter means for successively connecting the selected battery circuits or branches to line, a lock out controlled by the operation of any of said type and means for releasing said lock out controlled by the operation of said automatic transmitter means, substantially as described.

15. In automatic transmitters, the combi-

nation with a set of switches and a set of battery circuits or branches controlled thereby, of a series of character type, each switch being operated by a number of said type and each type being arranged to select a particular combination of switches and battery circuits or branches, automatic transmitter means controlled by the operation of said type for successively connecting the selected branches to line, a lock out for holding the selected type in shifted position and for preventing the operation of the other of said type, an operating magnet for said lock out and a circuit therefor closed by the operation of any of said type and opened at the end of the operation of said automatic transmitter means, substantially as described.

16. In automatic transmitters, the combination with a set of switches and a set of battery circuits or branches controlled thereby, of a set of switch-operating bars, a set of character type having variably arranged projections for operating different combinations of said bars and switches to select particular combinations of said battery circuits or branches, a set of keys controlling the operation of said character type, transmitter means for automatically and successively connecting the selected battery circuits or branches to line, a lock-out for holding the selected type in shifted position and for preventing the operation of the other of said type, and operating circuits for said transmitter means and for said lock-out controlled by the operation of said character type, said lock-out circuit being broken by the operation of said transmitter means at the end of the transmission of the selected signal, substantially as described.

17. In automatic transmitters, the combination with a set of switches and a set of battery circuits or branches controlled thereby, of a set of switch-operating bars, a set of character type having variably arranged projections for operating different combinations of said bars and switches to select particular combinations of said battery circuits or branches, a set of keys controlling the operation of said character type, transmitter means for automatically and successively connecting the selected battery circuits or branches to line, a series of latches, one for each of said character type, a common shifter coöperating with said latches for holding the selected type in shifted position and prevent the operation of the other type and controlling keys, an operating magnet for said shifter, a circuit for said magnet controlled by the operation of any of said keys and type, an operating circuit for said transmitter means controlled by the operation of said type and devices controlled by said transmitter means for opening the circuit of said lock-out magnet at the completion of a selected signal, substantially as described.

18. In automatic transmitters, the combination with a set of battery circuits or branches, of a series of character type, a set of switches variably operated by said character type to select different combinations of battery branches or circuits, transmitter means controlled by said keys for automatically and successively connecting the selected battery branches to line and means controlled by each key and by said transmitter means for preventing the shift of the other of said keys until the complete transmission of the selected signal or combination, substantially as described.

19. In automatic transmitters, the combination with a set of battery circuits or branches, of a series of finger keys, a series of character type, one operated by each key to select a particular combination of said battery circuits or branches, transmitter means controlled by the keys for automatically and successively connecting the selected battery branches to line, and a lock-out device for holding the selected type in shifted position and for preventing the operation of the other of said type, substantially as described.

20. In automatic transmitters, the combination with a set of switches and a set of battery branches or circuits controlled thereby, of a set of character type each operating to select a particular combination of switches and battery circuits or branches, a series of keys for operating said type, yielding operating connections between said keys and said type and means for holding the selected type in shifted position and for preventing the operation of the keys of the other of said type, substantially as described.

21. In automatic transmitters, the combination with a set of switches and a set of battery branches or circuits controlled thereby, of a set of character type each operating to select a particular combination of switches and battery circuits or branches, a series of keys for operating said type, spring-held, yielding connections between said keys and the type, through the medium of which the latter are operated, and means coöperating with said keys and type for holding the selected type in shifted position and for preventing the operation of the other of said type and keys, substantially as described.

22. In automatic transmitters, the combination with a set of switches and a set of battery branches or circuits controlled thereby, of a set of devices each arranged to simultaneously select a particular combination of said switches and battery branches or circuits, a set of transmitter switches for connecting the selected battery branches or circuits to line, an operating relay for each

transmitter switch, comprising two magnets, one acting to close the switch and the other to open the same, and means for closing the circuit of said relay magnets in order, substantially as described.

23. In automatic transmitters, the combination with a set of switches and a set of battery branches or circuits controlled thereby, of a set of devices each arranged to simultaneously select a particular combination of said switches and battery branches or circuits, a set of transmitter switches for connecting the selected battery branches or circuits to line, an operating relay for each transmitter switch, comprising two magnets, one acting to close the switch and the other to open the same, means for closing the circuits of said relay magnets in order and means for opening the circuits of said magnets at the completion of the selected signal, substantially as described.

24. In automatic transmitters, the combination with a set of switches and a set of battery branches or circuits controlled thereby, of a set of devices each arranged to simultaneously select a particular combination of said switches and battery branches or circuits, a set of transmitter switches for connecting the selected battery branches or circuits to line, an operating relay for each transmitter switch, comprising two magnets, one acting to close the switch and the other to open the same, means operated by each relay magnet for closing the succeeding relay magnet, means for closing the circuit of the first relay magnet, and means controlled by the operation of the last relay magnet for opening the circuits through said magnets, substantially as described.

25. In automatic transmitters, the combination of a set of switches and a set of battery branches or circuits controlled thereby, of a series of character type for operating said switches, each switch being operated by a number of different type and each type being arranged to operate a particular combination of switches, transmitter means comprising a set of switches for successively connecting the selected battery branches or circuits to line, a relay for operating each switch, comprising two magnets, one acting to close the switch and the other to open the same, means operated by each magnet for closing the succeeding relay magnet of the set and means controlled by the operation of the last relay magnet for opening the circuits of said magnets, substantially as described.

26. In automatic transmitters, the combination of a set of switches and a set of battery branches or circuits controlled thereby, a series of character type having variably arranged projections each adapted to select a particular combination of switches and battery branches or circuits, transmitter means comprising a set of relays automatically acting in succession to connect the selected battery branches or circuits to line, a series of keys for operating said character type, means controlled by said keys for initiating the operation of said set of relays, and means compelling the complete operation of said set of relays when the operation thereof is once initiated, substantially as described.

27. In automatic transmitters, the combination of a set of switches and a set of battery branches or circuits controlled thereby, a series of character type having variably arranged projections each adapted to select a particular combination of switches and battery branches or circuits, transmitter means comprising a set of relays automatically acting in succession to connect the selected battery branches or circuits to line, a series of keys for operating said character type, means controlled by said keys for initiating the operation of said set of relays, and a lock-out controlled by each key for preventing the operation of the other of said keys and means controlled by the operation of said set of relays for releasing said lock-out, substantially as described.

28. In automatic transmitters, the combination with a set of switches and a set of battery branches or circuits controlled thereby, a series of character type having variably arranged projections each adapted to select a particular combination of said set of switches and battery branches or circuits, a series of keys controlling the operation of said character type, a set of transmitter relay magnets for successively connecting the selected battery branches or circuits to line, means operated by each magnet of the set for closing the circuit to the succeeding magnet, means controlled by the keys and type for closing the circuit of the first magnet of the set, a lock-out device for said keys and type, an operating magnet therefor, means controlled by the keys and type for closing the circuit of said lock-out magnet and means controlled by the last transmitter magnet for opening the circuits of said transmitter magnets and said lock-out magnet, substantially as described.

29. In automatic transmitters, the combination with a set of battery branches or circuits and with a set of key controlled devices each arranged to select a particular combination of battery branches or circuits, of a set of transmitter relays automatically acting to successively connect the selected battery branches or circuits to the line, each relay comprising two magnets, means operated by the first relay magnet for closing the circuit of the second relay magnet and means operated by the second relay magnet for closing the first magnet of the succeeding relay, and a switch arranged to be first

closed and then opened by the successive operation of the magnets of each relay, substantially as described.

30. In automatic transmitters, the combination with a set of battery branches or circuits and with a set of key controlled devices each arranged to select a particular combination of battery branches or circuits, of a set of transmitter relays automatically acting to successively connect the selected battery branches or circuits to the line, each relay comprising two magnets, the armature of the second magnet being movably mounted upon the armature of the first magnet, means for closing the circuits of said relay magnets in succession and a switch arranged to be first closed and then opened by the compound movement of the armature of the second relay, substantially as described.

31. In automatic transmitters, the combination with a set of battery branches or circuits and with a set of key controlled devices each arranged to select a particular combination of battery branches or circuits, of a set of transmitter relays automatically acting to successively connect the selected battery branches or circuits to line, each relay comprising two magnets, the armature of the second magnet being movably mounted upon the armature of the first magnet, contacts controlled by the armature of the first magnet for closing the circuit to the second relay magnet, contacts controlled by the armature of the second magnet for closing the circuit of the first magnet of the succeeding relay and a switch arranged to be successively closed and opened by the compound movement of the armature of the second magnet of each relay, substantially as described.

32. In automatic transmitters, the combination with a set of key controlled devices, each arranged to transmit a particular combination of differently modified impulses, of a shift key and means controlled thereby for transmitting one special combination of modified impulses when the key is depressed and another special combination of modified impulses when the key is released, substantially as described.

33. In automatic transmitters, the combination with a series of switches, of shift mechanism for operating said switches, and a series of finger keys for selectively controlling the operation of said switches and said shift mechanism, said mechanism being arranged to hold the selected switches in shifted position until the signal transmitted thereby is completed.

34. In automatic transmitters, the combination with a series of switches, of a series of selecting finger keys therefor, and devices movable independently of said keys, but controlled thereby for operating different combinations of said switches and for holding the same in shifted position until the signal transmitted thereby is completed.

35. In automatic transmitters, the combination with a series of switches, of a series of character type operating different combinations of said switches, shift mechanism for actuating said character type and for holding the same in shifted position until the signal transmitted thereby is completed, and a series of keys controlling the operation of said character type and of said shift mechanism, substantially is described.

36. In automatic transmitters, the combination with a series of switches, of a series of character type for operating different combinations of said series of switches, an operating shifter for said type, an electro magnet for actuating said shifter, a set of character keys selectively controlling the operation of said type and means controlled by said keys for energizing said magnet, substantially as described.

37. In automatic transmitters for printing telegraphs, the combination with a series of character keys and means controlled by each of said keys for transmitting a particular combination of varied impulses to the line, of a special shift key and means operated thereby for transmitting a special combination of varied impulses when said key is depressed and another special or releasing signal when said key is released, substantially as described.

38. In automatic transmitters for printing telegraphs, the combination with a series of character keys and means controlled by each of said keys for transmitting a particular combination of varied impulses to the line, of two special shift keys and means controlled thereby for sending different special or shifting code combinations to the line when one or the other of said keys is depressed and for transmitting the same special or releasing code combination when either of said keys is restored to normal, substantially as described.

39. In automatic transmitters for printing telegraphs, the combination with a series of battery circuits or branches, of a set of character keys, means operated by each of said keys for simultaneously selecting a particular combination of battery circuits or branches, transmitter means for successively connecting the selected battery branches or circuits to line, a special shift key and means controlled by said key for selecting one combination of battery circuits or branches when the key is depressed and another combination when said key is released, substantially as described.

40. In automatic transmitters for printing telegraphs, the combination with a series of battery circuits or branches, of a set of character keys, means operated by each of said keys for simultaneously selecting a par-

ticular combination of battery circuits or branches, transmitter means for successively connecting the selected battery branches or circuits to line, two special shift keys and means operated thereby for connecting different combinations of said battery circuits or branches to the transmitter means when one or the other of said keys is depressed and for connecting the same combination of battery branches or circuits to said transmitter means when either of said keys is released, substantially as described.

41. In automatic transmitters, the combination with a set of battery circuits or branches, of a series of key-controlled devices, each arranged to simultaneously select a particular combination of battery branches, a set of relays automatically acting to successively connect the selected branches to line, a special shift key and means operated thereby for connecting two different combinations of battery branches to said transmitting relays when said key is depressed and released respectively, substantially as described.

42. In automatic transmitters, the combination with a set of battery branches or circuits, of a series of character keys, means controlled by each key for selecting a particular combination of battery branches, a set of relays controlled by said keys and acting automatically to successively connect the selected battery branches to line, two special shift keys, means controlled thereby for selecting different combinations of battery branches when one or the other of said keys is depressed and for selecting the same combination when either of said keys is restored to normal position and means controlled by said special shift keys for initiating the operation of said set of relays when either of said keys is depressed or when it is released, substantially as described.

43. In automatic transmitters, the combination with a series of keys and means controlled by each of said keys for transmitting a particular or characteristic combination of impulses, of a pair of relays, means controlled by said relays for transmitting special code combinations of impulses, a shift key and means controlled by said shift key for energizing one of said relays when the key is depressed and the other when said key is released, substantially as described.

44. In automatic transmitters, the combination with a series of keys and means controlled by each of said keys for transmitting a particular or characteristic combination of impulses, of a set of three relays, means controlled by each of said relays for transmitting a particular or characteristic combination of impulses, two special shift keys and means operated by each of said keys for energizing one of the relays of said set when depressed and for energizing the third relay of the set when either of said keys is released and restored to normal position, substantially as described.

45. In automatic transmitters, the combination with a series of key-controlled devices, each arranged to transmit the particular or characteristic combination of impulses, of two relays, two switches, one controlled by each of said relays and arranged to be first closed and then opened when the corresponding relay is energized, means controlled by each of said switches for transmitting a particular combination of impulses, a switch in the energizing circuits of said relays normally holding the circuit of one relay closed and that of the other open and a special shift key for operating the switch to reverse the condition of the circuits of said relays both when it is depressed and when it is released, substantially as described.

46. In automatic transmitters, the combination with a set of battery branches, of a series of character keys, means controlled by each key for selecting a particular or characteristic combination of battery branches, a set of transmitting relays controlled by said keys for automatically and successively connecting the battery branches to line, two special relays, a switch for each special relay arranged to be first closed and then opened when the corresponding special relay is energized, means controlled by each switch for connecting a special combination of battery branches with the transmitting relays, a switch in the circuit of said special relays normally holding the circuit of one relay open and that of the other closed and a special shift key for operating said switch to reverse the condition of the circuits of said special relays both when it is depressed and when it is operated, substantially as described.

47. In automatic transmitters the combination with a series of switches, of character type for operating said switches, each of said switches being operated by a number of said type and each type operating a particular combination of switches, a series of keys controlling the operation of said type, and a common shifter controlled by said keys and arranged to hold the selected combination of switches in shifted position and prevent the operation of other of said type and keys until the completion of the signal transmitted by the selected combination of switches, substantially as described.

48. In automatic transmitters, the combination with a set of battery circuits or branches, of a set of finger keys, a series of character type, one operated by each key to select the particular combination of said battery circuits or branches, transmitter means controlled by said keys for automatically and successively connecting the said battery branches to line and a locking device for

compelling the complete operation of said transmitter means and for preventing the operation of said keys and character type, said locking device being controlled and set for operation by each of said keys.

49. In automatic transmitters, the combination with a set of battery circuits or branches, of a set of finger keys, a series of character type, one operated by each key to select the particular combination of said battery circuits or branches, transmitter means controlled by said keys for automatically and successively connecting the said battery branches to line, a locking device for compelling the complete operation of said transmitter means and for preventing the operation of said keys and type, means controlled by each of said keys for setting said locking device and means controlled by the operation of said transmitter means for releasing said locking device.

50. In automatic transmitters, the combination with a set of switches, of a series of finger keys, a series of character type, one operated by each key to select the particular combination of switches, a set of relays for automatically and successively connecting said switches to line, means controlled by each of said keys for initiating the operation of said set of relays, and a lock-out controlled by each of said keys for compelling the complete operation of said set of relays and for holding said switches against movement until the signal selected thereby is transmitted.

51. In automatic transmitters, the combination with a set of selected switches for varying the impulses transmitted, of a series of finger keys, a series of character type, one operated by each of said keys to select a particular combination of switches, a set of relays, the circuit of each relay being controlled by one of the preceding relays in the set, means controlled by each finger key for operating the first relay of the set, a lock-out device set for operation by each of said finger keys and means controlled by the complete operation of said set of relays for restoring said lock-out device.

52. In automatic transmitters, the combination with a set of selected switches for varying the impulses transmitted, of a series of finger keys, a series of character type, one operated by each of said keys to select a particular combination of switches, a set of relays, the circuit of each relay being controlled by one of the preceding relays in the set, means controlled by each finger key for operating the first relay of the set, a lock-out device for holding the selected type in shifted position and for preventing the operation of the other of said type, means controlled by each finger key for setting said lock-out device and means controlled by the complete operation of said set of relays for restoring said lock-out device.

53. In automatic transmitters, the combination of a set of switches, of a set of battery branches controlled thereby, of a series of character type for operating different combinations of said switches, a series of finger keys for selecting said type, a shifter controlled by said keys for operating the selected type and for holding the same in shifted position, transmitter means controlled by said finger keys for successively connecting the battery branches to line and means controlled by the operation of said transmitter means for restoring said shifter.

54. In automatic transmitters, the combination with a set of switches, of a set of battery branches controlled thereby, of a series of character type for operating different combinations of said switches, a series of finger keys for selecting said type, a shifter controlled by said keys for operating the selected type and for holding the same in shifted position, a set of relays for successively connecting said battery branches to line, the circuit of each relay being controlled by one of the preceding relays of the set, means controlled by each finger key for operating the first finger key of the set and means controlled by the complete operation of said relays for restoring said shifter to normal position.

55. In automatic transmitters, the combination with a line circuit, of transmitter means for imparting different combinations of modified impulses to the line, a set of character keys, means operated by each of said keys for selecting a particular combination of impulses and for initiating the operation of said transmitter means, a special shift key spring held in normal position, means controlled by said key for initiating the operation of said transmitter means both when said key is depressed and when it is returned to normal position, and means controlled by said key for selecting one combination of impulses when depressed and another combination when released, substantially as described.

56. In automatic transmitters for telegraphs, the combination with a line circuit and a series of battery circuits or branches, of a set of character keys, switch mechanism controlled by each of said keys for selecting a particular combination of battery branches or circuits, transmitter means for successively connecting the selective battery branches or circuits to line, means controlled by said keys for initiating the operation of said transmitter means, a special shift key spring held in normal position, means controlled by said key both when depressed and when released for initiating the operation of said transmitter means, and means controlled by

said key for selecting one combination of battery circuits or branches when depressed and another combination when released, substantially as described.

57. In automatic transmitters for telegraphs, the combination with a line circuit and a series of battery circuits or branches, of a set of character keys, switch mechanism controlled by each of said keys for selecting a particular combination of battery branches or circuits, transmitter means for successively connecting the selective battery branches or circuits to line, means controlled by said keys for initiating the operation of said transmitter means, a special shift key spring held in normal position, means controlled by said key both when depressed and when released for initiating the operation of said transmitter means, means controlled by said key for selecting one combination of battery circuits or branches when depressed and another combination when released, and means compelling the complete operation of said transmitter means when any one of said keys is operated.

58. In automatic transmitters for printing telegraphs, the combination with transmitter means for imparting different combinations of code impulses to the line, of a set of character keys, means operated by each key for selecting a particular combination of code impulses to be transmitted, a special shift key spring held in normal position, and means controlled by said key for selecting one combination of modified code impulses when depressed and another combination when said key is restored to normal position, substantially as described.

CHARLES L. KRUM.

Witnesses:

LILLIAN PRENTICE,
KATHARINE GERLACH.